Heating Piping & Air Conditioning

AUGUST 1954

INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

Page 123—Journal Section of The American Society of Heating and Ventilating Engineers

DID CARS LIKE THIS change heating practice? "Yes," says I. W. Cotton ..... page 108

Piping Flexibility Report 98

Does Air Conditioning Aid Efficiency? ..119

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*In addition to carbon steel and stainless steel**

GRINNELL
WELDING FITTINGS

may be had in

- **WROUGHT IRON**
- **ALUMINUM**
- **INCONEL**
- **PURE NICKEL & MONEL**
- **COPPER (Deoxidized)**
- **HASTELLOY ALLOYS, B & C**

Piping engineers can choose Grinnell Welding Fittings today from numerous materials having exceptional resistance to heat and cold, as well as the ability to cope successfully with troublesome fluids and gases.

Numbered among these are intermediate and high alloy steels containing chromium, nickel (or both)—plus other alloying elements such as molybdenum and copper. In addition, alloys are available which are composed primarily of nickel, copper or aluminum. Hastelloy Alloys B & C, developed primarily for severe chemical service, are also available.

Charted on this page are Grinnell Welding Fittings in a variety of materials and sizes.

**Covered in previous advertisements. Available on request.*

TYPE OF FITTING (All dimensions in inches)		WROUGHT IRON		ALUMINUM[1] Type 3S-F		INCONEL			NICKEL & MONEL			COPPER[2] Deoxidized		HASTELLOY ALLOYS B & C		
		Std. Wall	Ex. Str. Wall	Std. Wall	Ex. Str. Wall	Sch. 10	Std. Wall	Ex. Str. Wall	Sch. 10	Std. Wall	Ex. Str. Wall	Std. Wall	Ex. Str. Wall	Schedule 5	Schedule 10	Std. Wall
ELBOWS	90° Long Radius	½-12	½-12	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	½-8	½-8	½-8
	90° Short Radius	....	....	1-16	1½-16	....	....	....	....	....	....	....	....	....	....	....
	45° Long Radius	½-12	½-12	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	½-8	½-8	½-8
RETURNS	180° Long Radius	....	....	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	....	....	....
	180° Short Radius	....	....	1-16	1½-16	....	....	....	....	....	....	....	....	....	....	....
TEES	Straight Outlet	½-12	½-12	½-16	½-16	½-12	½-12	½-12	½-12	½-12	½-12	½-16	½-16	½ & Larger	½ & larger	½ & larger
	Reducing Outlet	½-12	½-12	½-16	½-16	½-12	¾-12	¾-12	½-12	¾-12	¾-12	¾-16	¾-16	½ & larger	½ & larger	½ & larger
CROSSES	Straight Outlet	....	....	½-12	½-12	....	....	....	....	....	....	....	....	....	....	....
	Reducing Outlet	....	....	½-12	½-12	....	....	....	....	....	....	....	....	....	....	....
REDUCERS	Concentric	1-12	1-12	½-16	½-16	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	½ & larger	½ & larger	½ & larger
	Eccentric	1-12	1-12	½-16	½-16	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	¾-12	½ & larger	½ & larger	½ & larger
STUB ENDS	ASA Length	½-12	½-12	½-24	½-24	½12-	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½ & larger	½ & larger	½ & larger
	Short Length	....	....	....	....	½-12	½-12	½-12	½-12	½-12	½-12	....	....	½ & larger	½ & larger	½ & larger
CAPS		¾-12	¾-12	½-24	½-24	½-12	½-12	½-12	½-12	½-12	½-12	½-24	½-24	½ & larger	½ & larger	½ & larger

1. Type 2S-F Alclad, 3S-F, and Type 61S-T6 also available.

2. Red brass, low silicon bronze, admiralty metal, aluminum bronze and other copper alloys available on request.

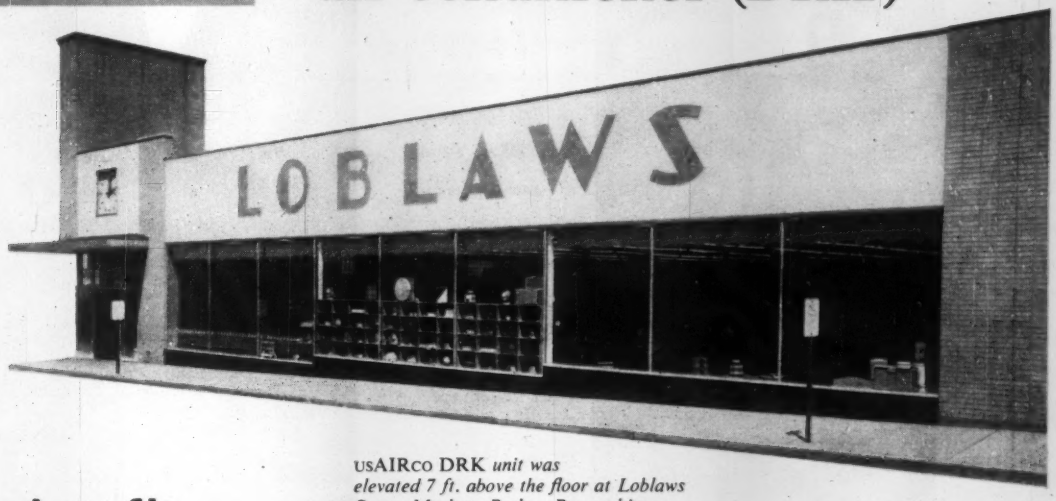
GRINNELL
WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems

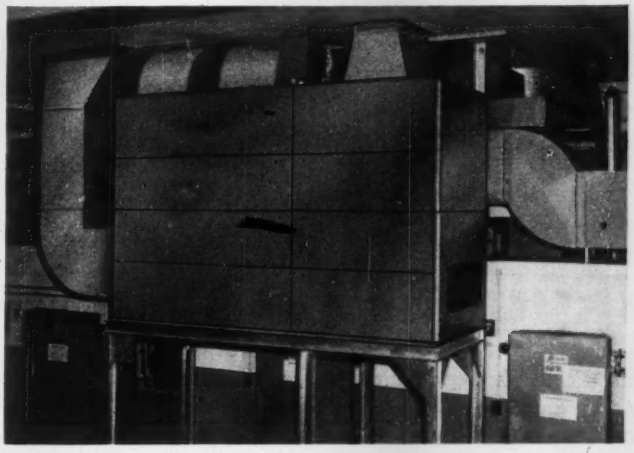
usAIRco

packaged central station air conditioner (DRK)



usAIRco DRK *unit was elevated 7 ft. above the floor at Loblaws Super Market, Butler, Pa. making room for storage of materials and leaving entrance to walk-in cooler unobstructed.*

licks floor space problem for chain grocery!



When Loblaw Super Market, Butler, Pa., lacked floor space for a standard air conditioning installation, the problem was solved by elevating a usAIRco DRK-20 unit above the floor, thus providing Loblaw's with the efficient, low-cost air conditioning they needed.

The compact structure and size of the DRK is ideal for problem installations and economical operation. Because its built-in evaporative condenser continually recirculates water, it saves 95% in water consumption. Installation costs are low because the DRK is delivered ready for operation from the factory, with all parts of the unit—blower section, compressor section and evaporative condenser—factory tested and balanced. Also, with the addition of a heating coil, the DRK will heat in winter.

Only three simple connections are needed: to ducts, water supply and drain, and power source. The DRK is available in single or dual circuit arrangements. 11 sizes, 3 through 60 h.p., to fit every requirement.

For further details write Dept. HP 84

UNITED STATES AIR CONDITIONING CORPORATION

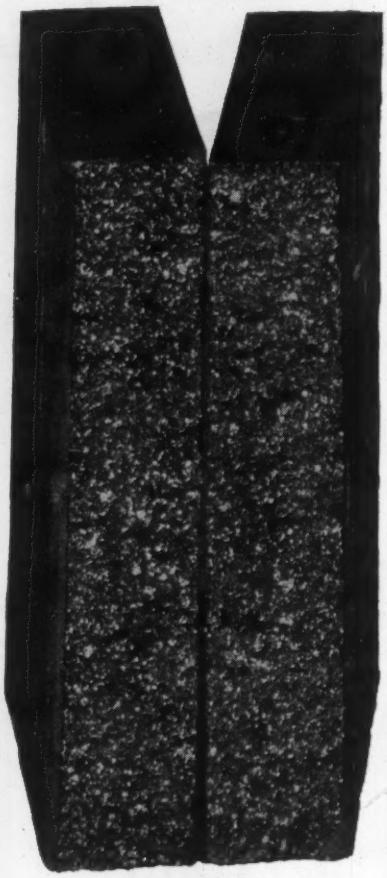
MINNEAPOLIS 14, MINN.

usAIRco

30 YEARS OF AIR CONDITIONING

HERE IS THE DIFFERENCE

WROUGHT IRON



STEEL

These are actual photographs of fractured pieces of wrought iron and steel. The picture at the left shows the fibrous structure of wrought iron. How this differs from the crystalline structure of steel is readily apparent. It is the presence of many thousands of tiny threads of glass-like iron silicate that gives wrought iron this unique fibrous structure and it is this structural feature, duplicated in no other metal, that gives wrought iron its superior resistance to corrosion and fatigue stresses.

While the initial cost may be higher, actual service records in numerous applications prove that wrought iron is the most economical buy because it lasts longer. Ask any Byers Field Service Engineer to show you fractured pieces, similar to those illustrated above. Write for our booklet, "The ABC's of Wrought Iron."

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. Export Department: New York, N.Y.

BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 26 No. 8

(with which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION AND MAINTENANCE IN INDUSTRIAL, COMMERCIAL, INSTITUTIONAL AND PUBLIC BUILDINGS

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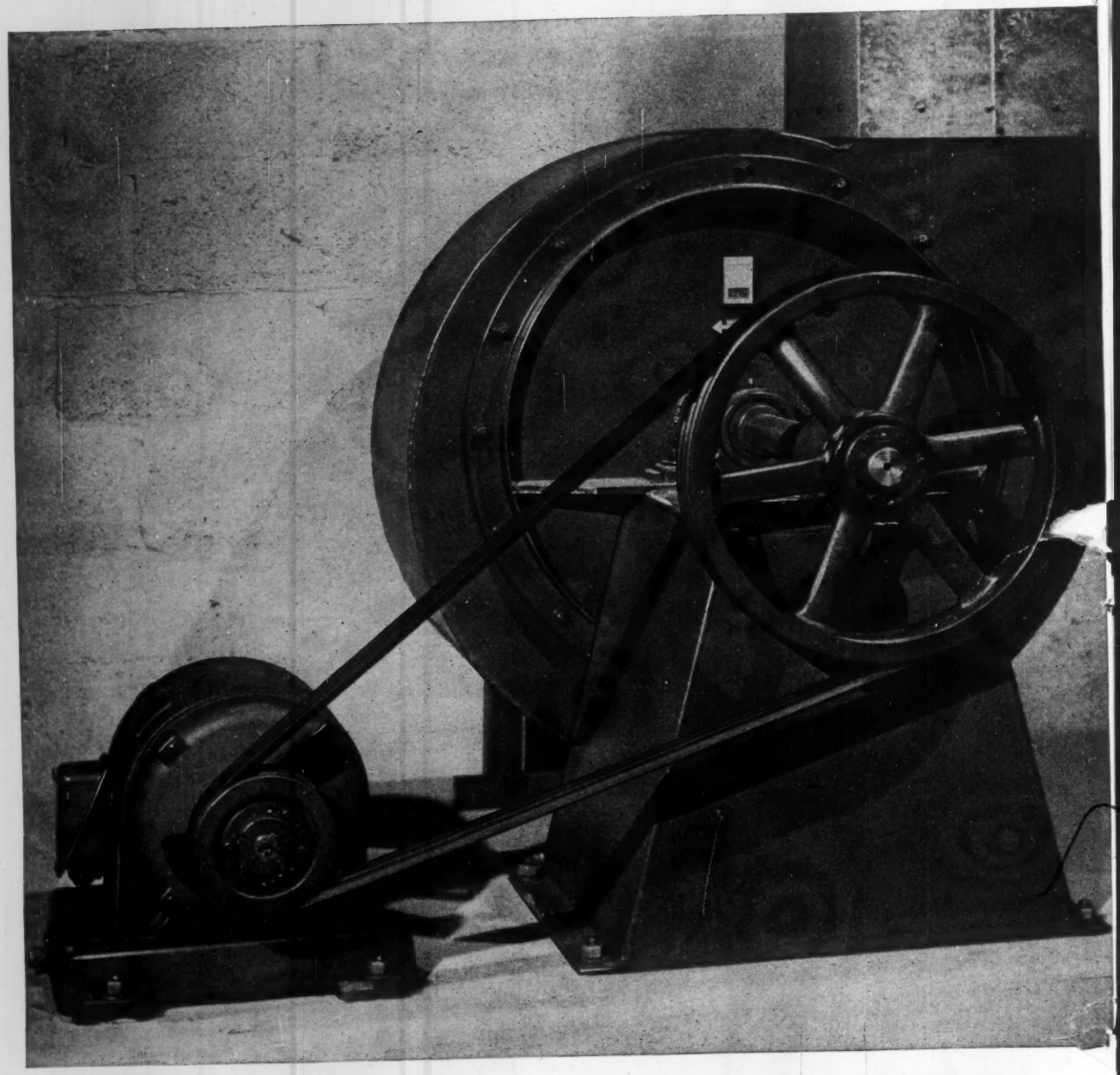
Complete
With 3 Extra



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Service

Allis-Chalmers Benefits

Put the Allis-Chalmers control-motor-drive combination on your air conditioning job and you'll benefit three ways:

1 Engineering Help

The local Allis-Chalmers district representative or distributor will engineer the complete control-motor-drive for you . . . you'll save *hours* and *dollars* of engineering time!

2 Coordinated Equipment

You don't have the problem of coordinating three sources of supply . . . A-C components are designed and built to work together smoothly and efficiently!

3 Guaranteed Performance

You get the benefit of one responsibility for equipment service and performance. The complete Allis-Chalmers control-motor-drive combination is *guaranteed* to perform as a unit. Nation-wide service is readily available.

Get Allis-Chalmers control-motor-drive combination on your next job . . . get these three benefits for a smoother, money-saving installation.

A-4208

Ample

NATION-WIDE STOCKS

A wide selection of control-motor-drive equipment used in the air conditioning industry is maintained by Allis-Chalmers district offices and authorized distributors. In addition, an efficient warehouse inventory system locates seldom-called-for items within hours after you call. For immediate action specify Allis-Chalmers equipment.

Nation-Wide

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With A-C equipment, there's always service near. Allis-Chalmers Certified Service Shops are independently owned... meet the high A-C standards for modern equipment, efficient methods, and business integrity. These shops assure your customers factory approved parts, equipment, and fast efficient service.

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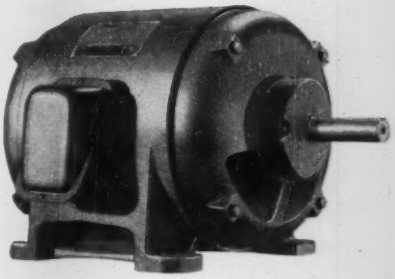
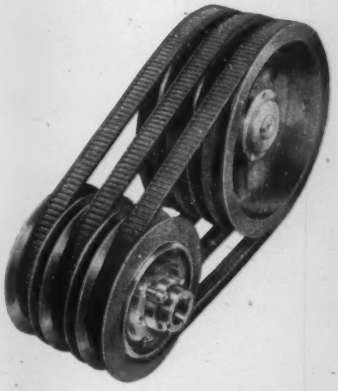
CONTROL



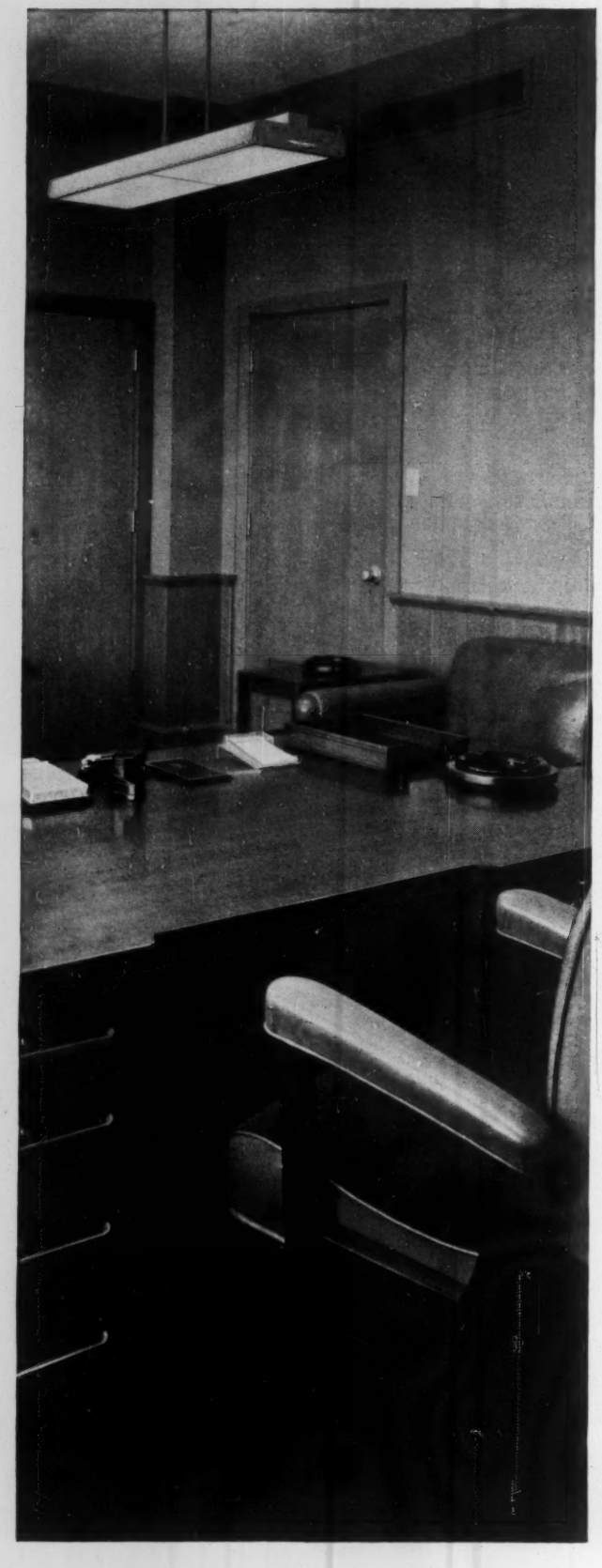
MOTOR



***Texrope* DRIVE**

CHALMERS

A-C ALLIS-CHALMERS



How Honeywell Customized Temperature Control can help you

Assure your clients ideal Indoor Weather –the year round

Honeywell Customized Temperature Control is becoming a "must" in all types of buildings

If all the air conditioning and ventilation duct-work in the new home office of the Allstate Insurance Company in Skokie, Illinois, were laid end to end, it would make a tunnel 2½ *miles long.*

Which is by way of saying how important ideal Indoor Weather is at Allstate–for hundreds of employees handling the affairs of 2,500,000 policy holders.

Another important part of the Indoor Weather installation in Allstate's new home office is the *Honeywell Customized Temperature Control* installation, which controls both heating and cooling.

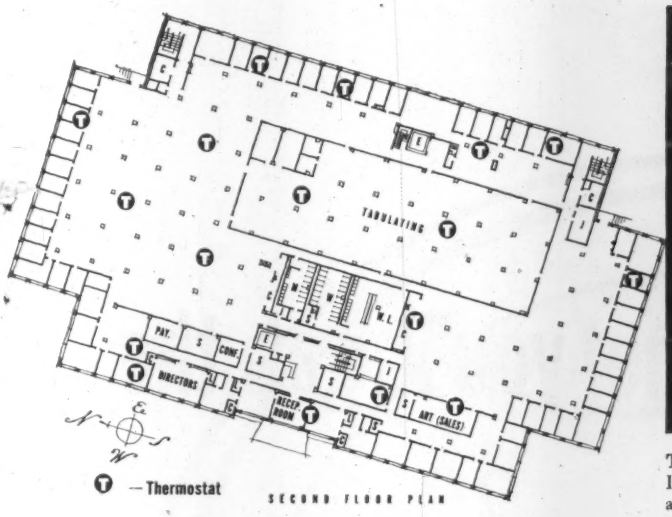
The story, in brief form, of the Honeywell Customized Temperature Control installation in Allstate's new home office is told by the pictures and captions on these two pages.

The *techniques* used, applied to your particular problems, can help you give clients the Indoor Weather they've always wanted–customized to their requirements.

The key word here is "customized." It means that whatever your clients' control requirements, a Honeywell Customized Temperature Control installation *designed to fit the needs of the building and its occupants* is your answer. This applies not only to heating and cooling, ventilating and humidity control but to industrial control as well.

Only Honeywell can provide a truly "customized" control installation. Because only Honeywell manufactures all three types of controls–pneumatic, electric and electronic.

The executive who occupies the office at left likes to work in temperatures that are cooler than average. This atmosphere he can have, because the office is equipped with its own thermostat. Individual office temperature control is an important feature of Honeywell Customized Temperature Control.



For comfortable, even temperature in new or existing buildings—of any size—specify Honeywell Customized Temperature Control

Whether it's an office, school, shopping center, factory, motel, hospital—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

They will not only enjoy more comfort and efficiency, they'll save fuel, too.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. Or mail the coupon today.

William Goodman, consulting mechanical engineer, says:

"Providing ideal Indoor Weather the year round sometimes gets to be quite a job. I'm sure glad to have Honeywell Customized Temperature Control available to help do the right kind of job."

MINNEAPOLIS
Honeywell

112 OFFICES ACROSS THE NATION

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
Dept. HA-8-145, Minneapolis 8, Minnesota
Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

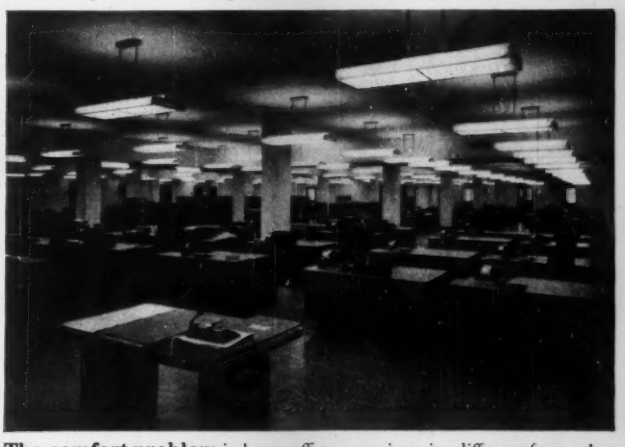
*Name*_____

*Firm Name*_____

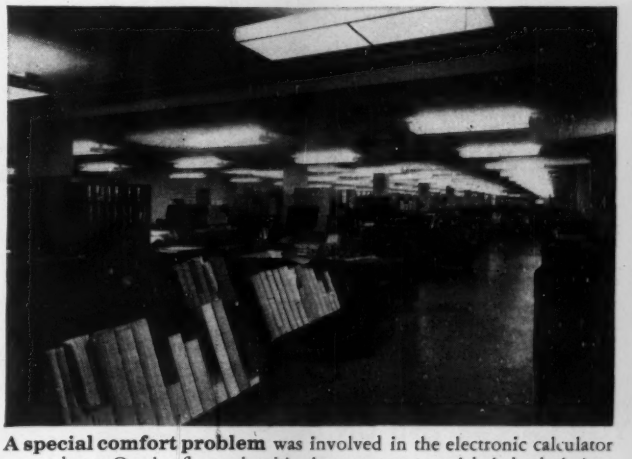
*Address*_____

*City*_____ *Zone*____ *State*_____

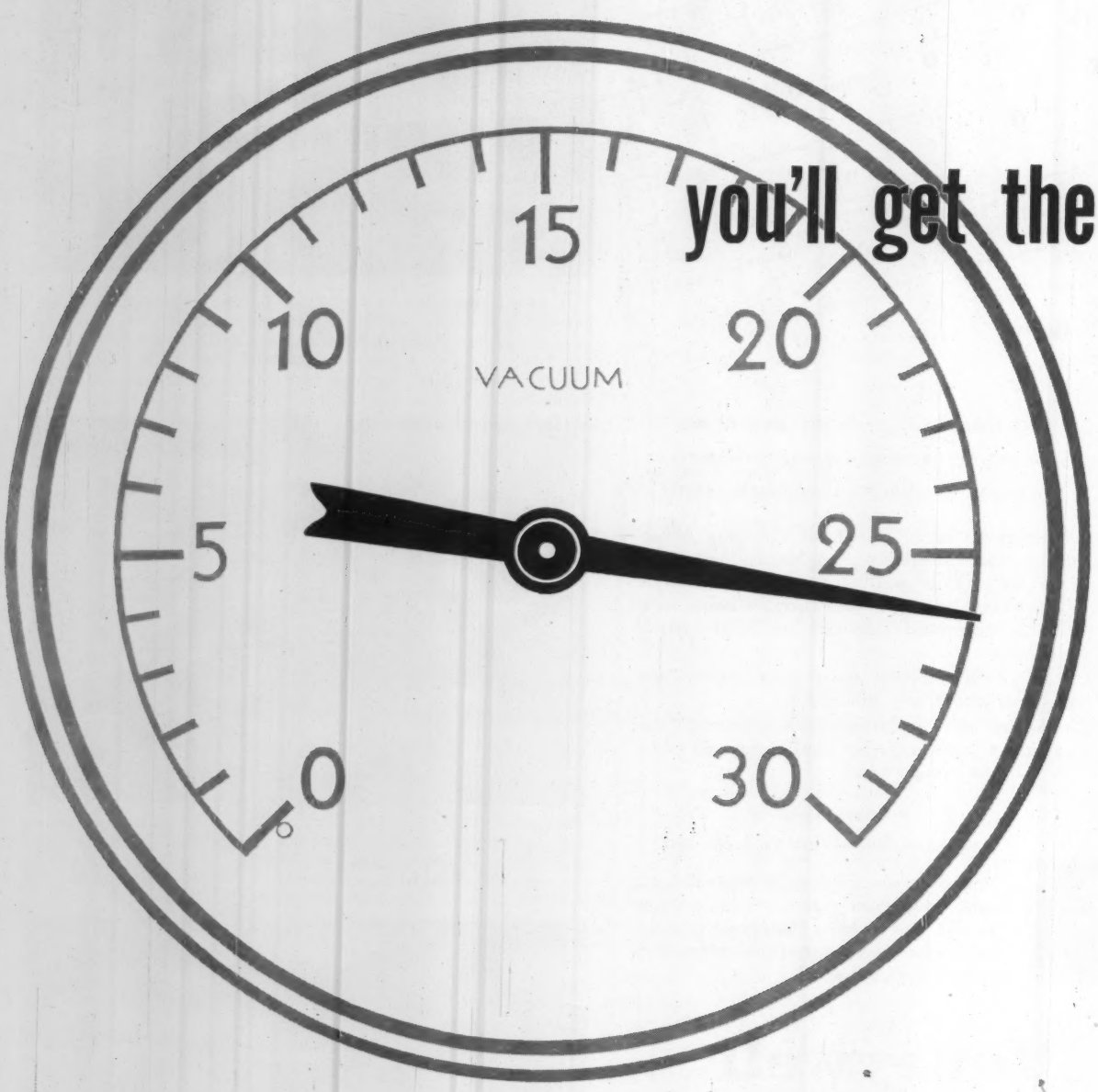
The new home office of the Allstate Insurance Company in Skokie, Illinois, is a three-story building of some 184,750 square feet. Large glass areas face all four directions. Yet with Honeywell Customized Temperature Control on the job, *comfort* is uniform throughout the building—all the time. Architects and engineers were Dunlap and Esgar, Inc., Chicago. Consulting mechanical engineer was William Goodman, Chicago.



The comfort problem in large office areas is quite different from what it is in the relatively small private office. More people are involved, the much greater area itself is important, exposure factors are heightened. In the area pictured above (located at left in the floor plan) three thermostats were needed to provide perfect comfort in all kinds of weather.



A special comfort problem was involved in the electronic calculator room above. On the floor plan it's that separate area labeled tabulating. Calculating machines, because of the way they work, just naturally give off heat. But this needn't cause discomfort—not with Honeywell Customized Temperature Control on the job. The right number of thermostats, strategically placed, insures perfect comfort at all times.



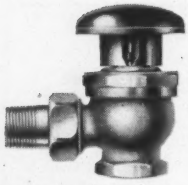
you'll get the

FROM RADIATOR TRAPS

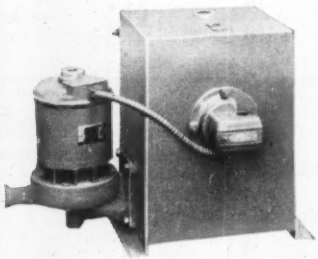
TO FULLY ENGINEERED SYSTEMS

YOU CAN *DEPEND ON DUNHAM* FOR

EVERYTHING YOU NEED IN HEATING

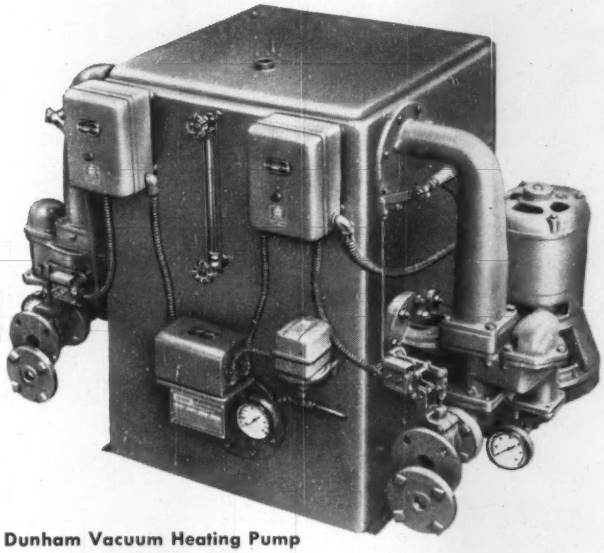


Dunham Radiator Valves. Complete line of specialties for both steam and hot water heating.



Dunham Condensate Pumps. Single and Duplex models. Low horsepower requirements. New mechanical seal.

same reading ten years from today



Dunham Vacuum Heating Pump
Single and Duplex models for capacities from 2,500 through 65,000 EDR

Read "behind" this vacuum gauge, and you'll see that Dunham Vacuum Heating Pumps perform as rated year after year, in properly installed and serviced systems, without expensive repairs—at low amperage.

That's because Dunham pumps have no fine tolerance parts—*need no close clearance adjustments to maintain full capacity.* One simple impeller is the only principal moving element.

Dunham gives you a pump "package" too. No extras to buy! All standard units have controls mounted and wired for immediate use. Duplex Pumps have mechanical alternator as standard equipment.

Low level inlet connections simplify installation. No vacuum on stuffing boxes. All important parts readily accessible outside of tank.

All standard pumps are rated in accordance with A.S.H.V.E. Vacuum Heating Pump Code. For new bulletin just off press, write C. A. Dunham Company, Dept. HPAC-8, 400 West Madison Street, Chicago 6, Illinois.

DUNHAM

RADIATION • CONTROLS

UNIT HEATERS • PUMPS • SPECIALTIES

HEATING & COOLING EQUIPMENT

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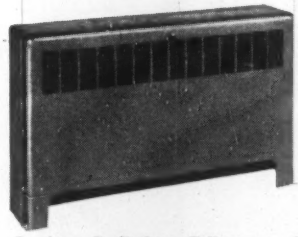
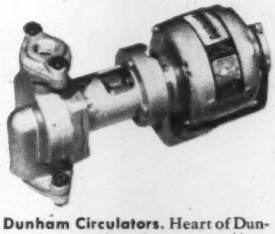
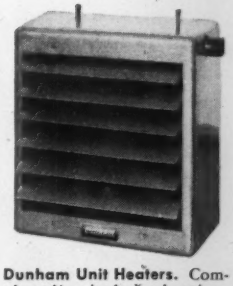


Dunham Radiation. Full range of sizes and types of convectors, baseboard and finned tube radiation.



Dunham Circulators. Heart of Dunham's complete hot water line. Single-spring motor coupling. Brand-name motor, compact, quiet.

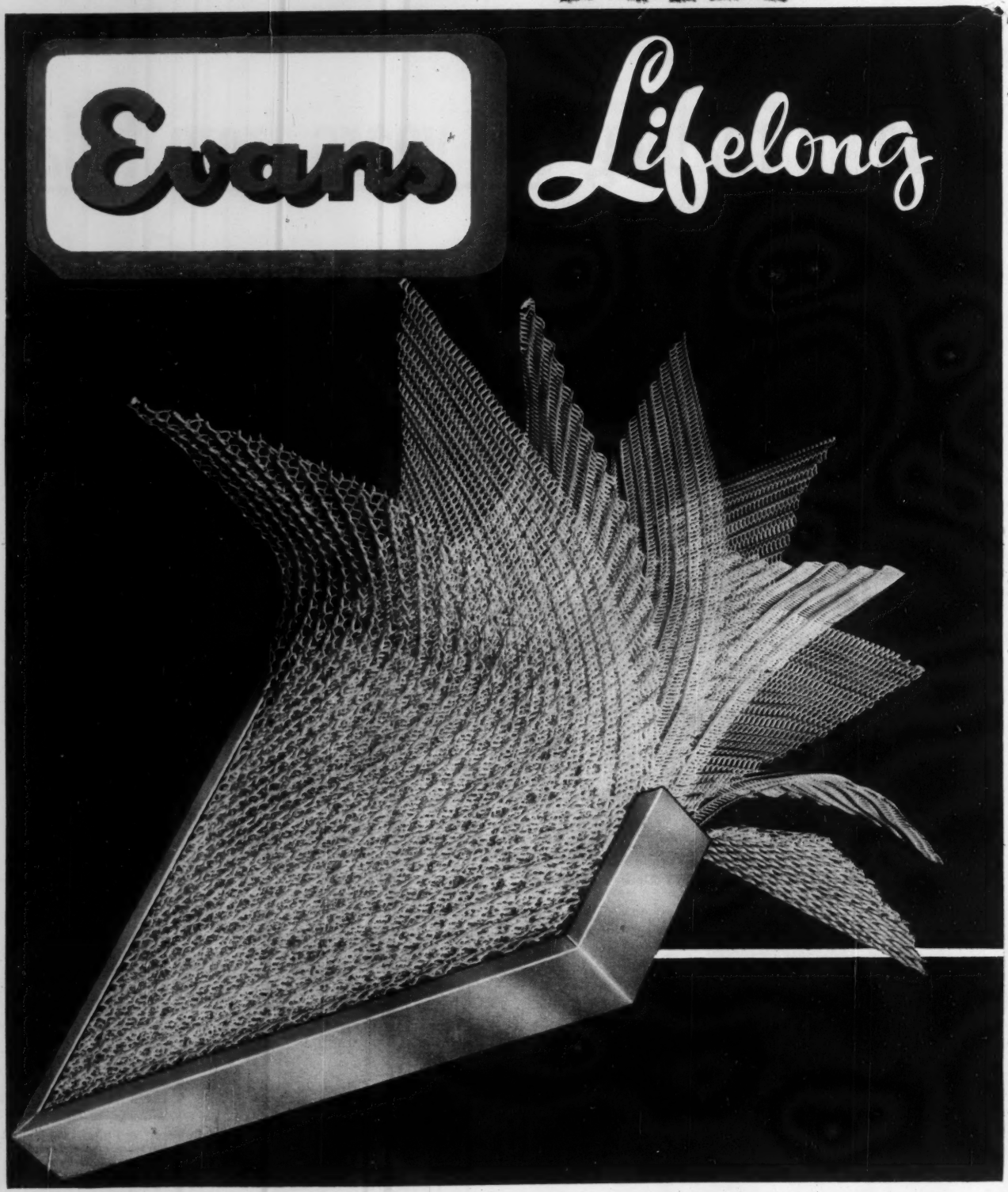


Dunham Unit Heaters. Complete line includes heating-cooling cabinet types, vertical discharge, horizontal discharge and large blower unit heaters.

Dunham Vari-Vac®. Engineered precision temperature control system uses continuous flow sub-atmospheric steam to cut fuel costs up to 40%.

WE DARE TO DISCUSS LINT *

Evans Lifelong



. . . THE MOST AVOIDED WORD IN AIR FILTERING

AIR FILTERS

*SPECIAL FILTERING ACTION CATCHES AND HOLDS LINT WITHOUT STOPPING AIR FLOW

Make no mistake about it . . . the above statement is not just a claim . . . IT IS AN ABSOLUTE PROVEN FACT. Proven with a test dust that contained 6 times as much lint as that generally accepted for filter testing.

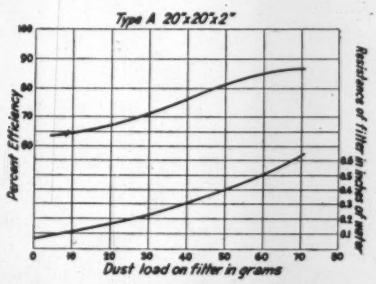
HERE IS THE COMPARISON

GENERALLY ACCEPTED TEST DUST	EVANS TEST* DUST
72% — standardized air cleaner test dust, fine, (Arizona Road Dust, fine)	61% — standardized air cleaner test dust, fine (Arizona Road Dust, fine)
25% — K-1 Carbon Black	21% — K-1 Carbon Black
3% — No. 7 Cotton Linters (percentages by weight)	18% — COTTON LINTERS . . . THESE LINTERS RANGING IN LENGTH FROM 1/8", 1/4", 3/8" and 1/2" WERE ADDED IN EQUAL PORTIONS TO GIVE AN ADDITIONAL 15% LINT TO THE FORMULA.

THIS NEW EVANS FORMULA WAS USED TO PROVIDE A TEST DUST WHICH WOULD BE MORE REALISTIC IN MATCHING EVERY DAY WORKING CONDITONS.

In addition to using dust with an 18% lint content Evans . . . in order to establish the most grueling possible conditions . . . employed a *continuous feeding process.*

The full amounts of dust were fed into the filter over a period of 2, 3 or 4 hours. (This process was continuous except for a 5 to 10 minute break at the end of each hour which was required to reload dust and fiber feeders.)



THESE EXCLUSIVE EVANS FEATURES MADE THIS PHENOMENAL FILTERING PERFORMANCE POSSIBLE

- **PRECISION ANGLED OPENINGS FORCE AIR INTO EXTREMELY HIGH TURBULENCE. CAUSE IT TO TRAVEL 3.5 TIMES DEPTH OF FILTER FROM INLET TO OUTLET SIDE.**
- **ROUGH, TALONLIKE BURRED EDGES GRIP AND HOLD DIRT AND LINT. FORCE AIR TO TRAVEL OVER 1.24 MILES OF THESE EDGES IN A 20" x 20" x 2" SIZE FILTER.**
- **NO THICK AND THIN SPOTS. AIR IS PULLED INTO FILTER EQUALLY OVER ENTIRE FILTER PACK SURFACE.**
- **RIGIDITY OF FILTER PACK ELIMINATES ALL FLUTTER.**
- **LARGE PRECISION CUT OPENINGS ON INLET SIDE HOLD MANY TIMES MORE LINT WITHOUT STOPPING AIR FLOW. UTILIZE FILTER DEPTH.**

AMAZING NEW MERCHANDISING POLICY PROTECTS DISTRIBUTORS, JOBBERS, AND DEALERS

Guarantees this protection. Opens an amazing new field in sales and profits.

If you are now handling an old-fashioned line of filters, which is not giving adequate filtering performance, adequate profits, adequate customer satisfaction and adequate territory protection, then get complete Evans story on both the new lifelong filter and the new merchandising policy.

INVESTIGATE NOW! MAIL THIS COUPON TODAY!

THE GEORGE EVANS CORPORATION, MOLINE, ILLINOIS

GENTLEMEN: Please send me: ☐ Descriptive Literature ☑ Merchandising Policy ☐ Price Lists

I WANT TO LEARN HOW TO MAKE MORE MONEY OUT OF THE FILTER BUSINESS.

NAME ..... COMPANY .....

ADDRESS .....

CITY ..... STATE .....

NOW! Full unit control in ...with Trane UniTrane

Each tenant dials his own climate with this air conditioning system. This is UniTrane! And UniTrane means *full unit control* in multi-room air conditioning. It's the system that offers all the desirable features of a central system . . . *plus* individually-controlled room units that cool or heat, dehumidify, ventilate, filter and circulate air for *personalized* climate control.

UniTrane meets widely varied demands—from large office buildings, hospitals, hotels and commercial buildings down to small apartments and motels. Because, with UniTrane, each tenant sets the temperature of his room just as *he* wants it, *without affecting the temperature or "climate" of any other room.* Tenants prefer it.

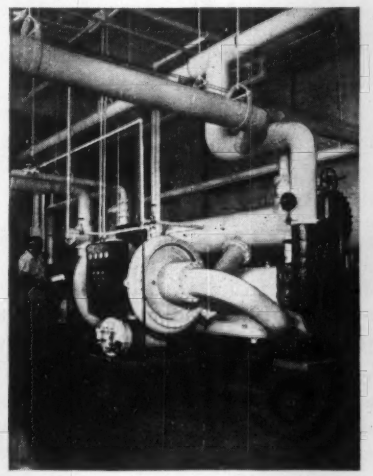
Management agrees UniTrane offers more. This unique combination of tenant advantages costs less to install, far less to operate. The same piping circuit is used for *both* heating and cooling. Individual room units can be shut off in unoccupied rooms without affecting operation of any of the other units. Operating load can be matched directly to fluctuating temperature requirements for lowest possible operating costs.

Architects especially like the savings in valuable floor space, the design freedom. Units are available in all sizes and types —free-standing, recessed, semi-recessed, ceiling—for either exposed or concealed installation.

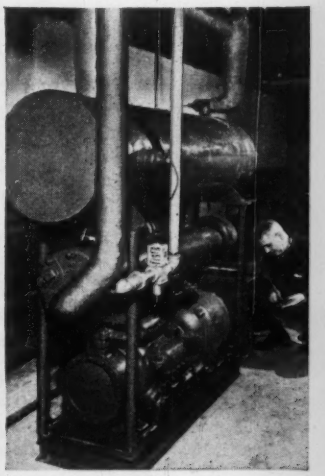
Discover for yourself just how easy it is to offer full *unit control* in multi-room air conditioning—with central system economy! Contact your nearest TRANE Sales Office or write TRANE, La Crosse, Wisconsin, for Bulletin DS-420B.

Typical installation in large office building shows unit free-standing under window. Models are also available for concealed wall or ceiling installations. Note how trim lines of UniTrane unit blend with smart room styling.

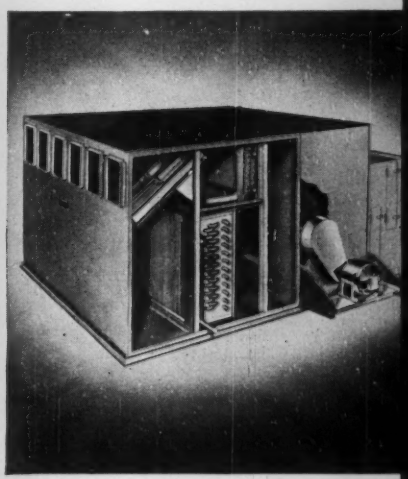
multi-room air conditioning Units



Trane CenTraVac supplies chilled water for UniTrane and TRANE Climate Changer units in large systems. Starts, stops, modulates automatically, with power consumption in almost direct proportion to load. Eight models, 45 to 400 tons.



Trane Cold Generator for smaller installations using UniTrane units or TRANE Climate Changers, or both. Delivers chilled water from one compact package. Engineered, built, tested and refrigerant-charged at the TRANE factory. 10 to 100 tons.



Trane Multi-Zone Climate Changers are air handling units which can heat, cool, humidify, dehumidify, ventilate and filter air (singly or in combination) for as many as *six* different zones at once. 28 models, 450 to 23,400 cfm.

In six of New York's newest skyscrapers TRANE Custom-Air systems are installed. The Custom-Air system utilizes UniTrane room units combined with a central source of ventilation air to give complete air conditioning comfort plus individual tenant control of room temperature. Installations include 99 Park Ave.; 579-589 Fifth Ave.; 7 Park Ave.; 261 Madison Ave.; 720 Fifth Ave.; 460 Park Ave.

ne source • one esponsibility

Specify TRANE UniTrane Units

for personalized climate control

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATION AND HEAT TRANSFER EQUIPMENT

The Trane Company, La Crosse, Wis. • East. Mfg. Div., Scranton, Penn. • Trane Co. of Canada, Ltd., Toronto
90 U.S. and 15 Canadian Offices

ACCO products

CAST STEEL

PRESSURE CLASSES FROM 150 TO 2500 PSI

• R-P&C's cast steel valve line includes gate, globe, angle, swing check and lift check styles in a wide variety of sizes, pressure classes and body and trim materials. Typifying the quality construction of the entire cast steel line is the valve illustrated at left, the

fig. 1501—This popular OS&Y flanged end gate valve has a primary rating of 150 psi at 500° F. It is furnished in sizes from 1½" to 24". Construction features that lengthen valve life, lower maintenance requirements, include:

wedge and wedge guides—Solid I-beam type wedge for maximum resistance to distortion. Wedge guides, cast to true center of seating surfaces, guide wedge to a perfect seat—make contact only at point of closure.

seat rings—Bottom-seated type, of heavy uniform cross section. There are no points of high stress concentration. Broad seat contact and smooth finish give longer life, less wear. Port openings are full pipe diameter for lower pressure drop.

stainless steel trim—Regularly furnished with 12-14% chromium trim for greater corrosion resistance. Other trim materials, suitable for a wide variety of special services, furnished on request.

stem—Head forged integral engages wedge slot, provides self-alignment.

packing—Long fibers of 95% chrysotile asbestos are square braided and reinforced by wire insertions, lubricated with graphite and oil. This special packing produces tight joints at high temperatures and pressures, lowers stem friction, decreases maintenance requirements.

castings—All castings produced in R-P&C's own foundry under careful metallurgical controls. Conform fully to requirements of standardization societies and customers' specifications.

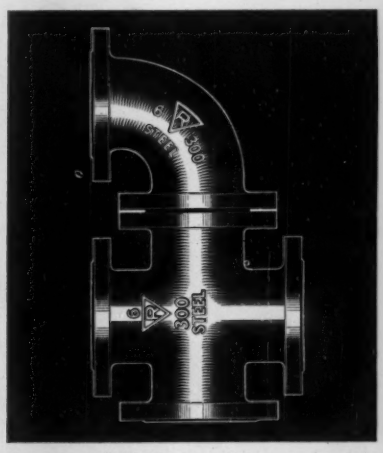
for further information on Fig. 1501 or other R-P&C cast steel valves, write for Catalog 9

VALVES from 1½" to 24"!

FROM R-P&C's COMPLETE LINE

Pressure sealed bonnet joint cast steel valves are furnished in gate and globe valve styles in 900 lb., 1500 lb., and 2500 lb. pressure classes.

Bar stock valves are precision machined from highest quality bronze, carbon steel, or alloy steel bar stock. Working pressures for carbon steel range from 10,000 lbs. at 150°F to 475 lbs. at 1,000° F. Sizes from ⅛" to 1".



Cast steel fittings, ells, tees, laterals, crosses, reducers — screwed or flanged ends. Furnished in a wide variety of sizes up to 24", in pressure classes from 150 lbs. to 2500 lbs.

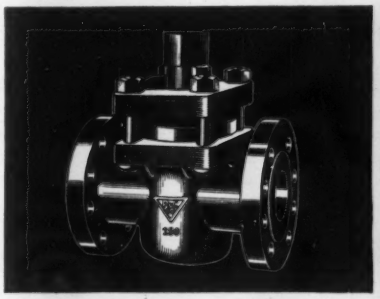
THE SECRET OF R-P&C's BETTER VALUES— QUALITY CONTROL

• A vital component of each R-P&C Valve is an ingredient you can't see. This hidden ingredient insures that you get the trouble-free operation and longer life engineered into each R-P&C design.

This hidden ingredient is called "quality control." It is a philosophy that dominates every step of the manufacturing operations that produce each R-P&C Valve.

Castings for every R-P&C Valve are produced in our own foundries under careful metallurgical controls. Casting soundness is verified by special radiographic techniques using radium or radioactive isotopes. Dimensional accuracy of each valve part is checked by a variety of gauging methods, including some specially developed by R-P&C engineers.

Before it leaves the factory, the performance of each valve is proved by individual hydrostatic and other tests. These tests are normally conducted at pressures higher than those for which the valves are rated.



Asbestos-packed cocks, an R-P&C exclusive, are furnished in iron in sizes from ¼" to 6" with screwed or flanged ends.

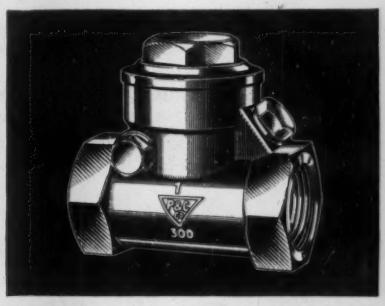


Fig. 212 screwed end bronze check valve typifies R-P&C's complete check valve line — furnished in iron, bronze or cast steel in sizes ranging from ¼" to 24".

WHICH OF THESE HELPFUL TECHNICAL AIDS DO YOU WANT?

R-P&C provides a wide variety of free technical aids to assist the buyer in valve selection, installation and operation. Among these are:

Valve Selector Slide Rule. Handy selector slide rule gives all dimensions for iron body valves, steel valves in 150, 300, 400, 600, 900 and 1500 lb. classes.

How To Select Valves. 17" by 11" wall chart lists principles to use in selecting valves for various applications . . . considers effects of fluids, temperatures, pressures, sizes, service requirements.

How To Protect Your Valves. 17" by 11" wall chart lists 22 installation and operation pointers to protect valves, get maximum life.

How To Know Valves. 17" x 11" wall chart graphically illustrates appearance, construction, operation, recommended applications for gate, globe and check valves, cocks.

Any of these free technical aids furnished promptly on request
Write R-P&C Valve Division, American Chain & Cable, Reading, Pennsylvania

ACCO

TRADE MARK

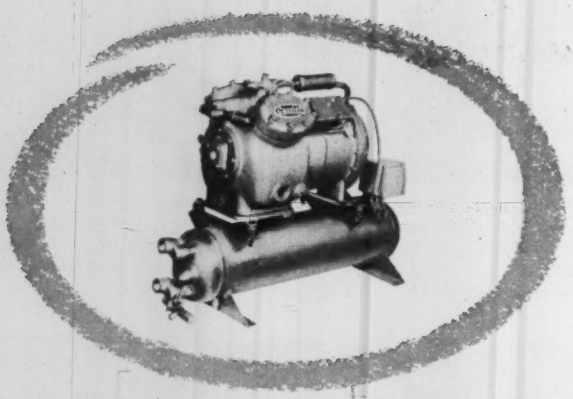
R-P&C Valve Division
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

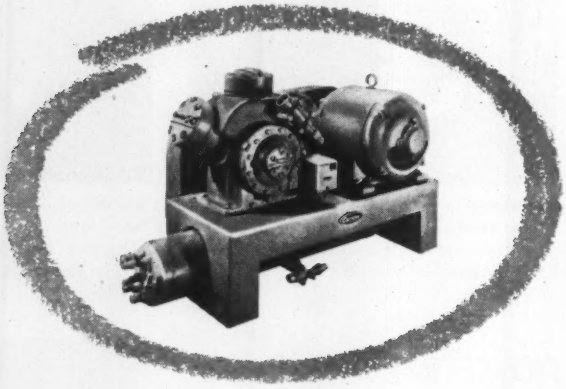
R-P&C valves

4 POINTS AND 8 EXAMPLES

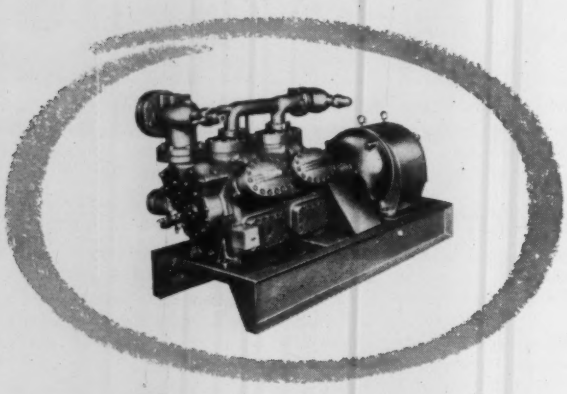
tell why you're better off with Carrier Compressors



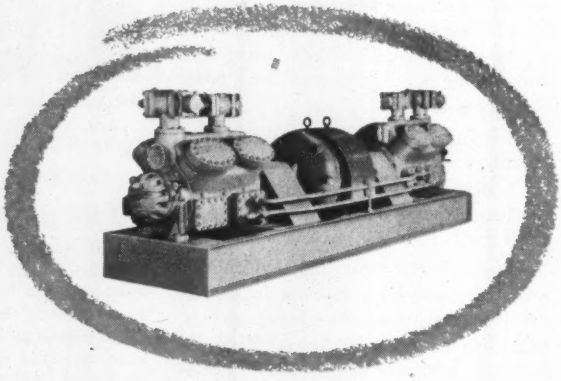
6D SERIES HERMETIC CONDENSING UNITS—Carrier has them in three capacities; 3, 5 and 7½ hp. Motor and compressor assemblies are sealed against dirt, moisture and air, yet easily unbolted for on-the-spot servicing.



5F SERIES CONDENSING UNITS—for a wide variety of air conditioning and refrigeration applications. Direct or belt drives. Two and three cylinder compressors with capacities of 3, 5 and 7½ hp. For use with water-cooled or evaporative condensers.

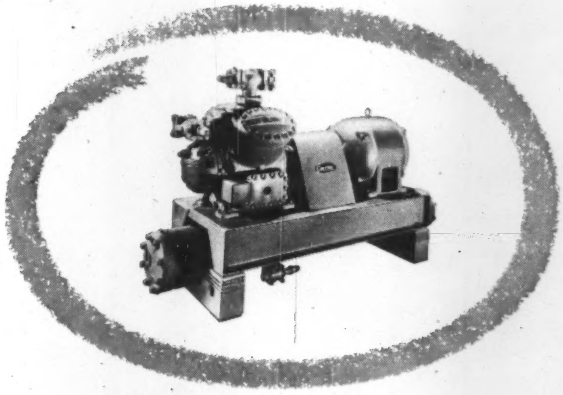


5H SERIES CONDENSING AND COMPRESSOR UNITS—8 and 12 cylinder, heavy-duty refrigerating machines with capacities of 40, 50, 75 and 100 hp. 40 and 50 hp units have built-in, water-cooled condensers. The larger compressors require separate condensers.

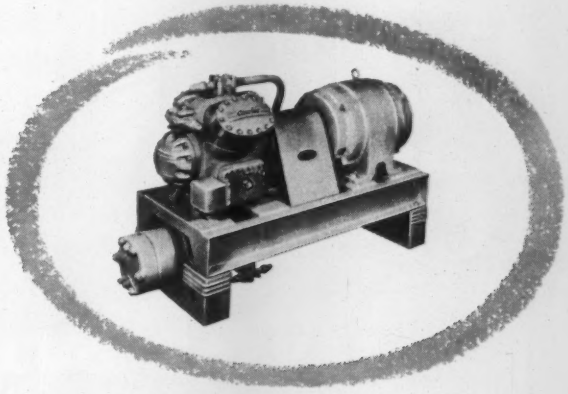


5H SERIES DUPLEX COMPRESSORS—direct-driven refrigerating machines consisting of a double-shafted motor and two compressors combined to provide capacities of 60, 75, 100 and 125 hp. Used with separate condensers.

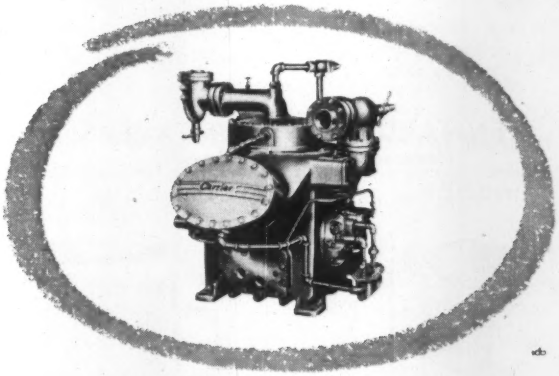
1. The modern, high-speed design of Carrier Compressors pays off in drastically reduced size, weight and vibration. You have greater freedom in locating and installing Carrier equipment. Units can be placed in upper stories, for example.
2. Only Carrier Compressors have *all* these features: Positive lubrication and vapor cushioned valves for longer life. Replaceable moving parts for low-cost maintenance. Automatic load-free starting and load levelers for operating economy.
3. The Carrier name is easiest for you to sell because customers know it and respect it. And Carrier backs you up in the application and servicing of every installation.
4. Carrier offers a wide choice of standard refrigerants.



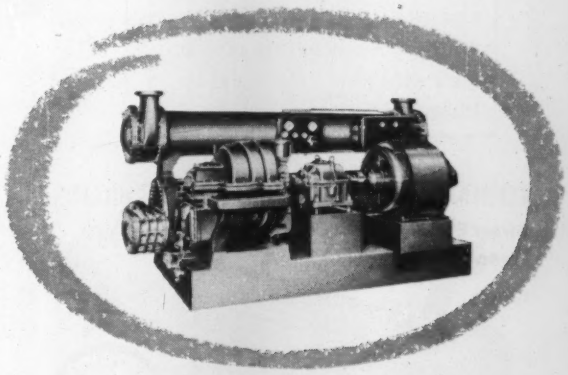
5F SERIES CONDENSING UNITS with 7½, 10 and 15 hp compressors. Direct or belt drives. Four and six cylinders with automatic unloading for easy starting. Available for use with water-cooled or evaporative condensers.



5H SERIES CONDENSING UNITS in capacities of 20, 25 and 40 hp. V and W type compressors are equipped with external, pressure type oil filters. Condenser package includes muffler in discharge pipe for extra quiet operation.



5J SERIES COMPRESSORS—heavy-duty, single-acting, V and W type refrigerating compressors for large commercial and industrial applications and comfort air conditioning. Four and six cylinder models have capacities of 75, 100, 125, 150 and 200 hp.



17 SERIES CENTRIFUGAL REFRIGERATING MACHINES with capacities up to 2500 tons. Products of more than 30 years of Carrier pioneering, these multi-stage centrifugals are used in more comfort and process applications than any other make.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Carrier Corporation, its distributors and dealers, stand ready and willing to work with you in any phase of air conditioning. Call your local Carrier distributor or dealer. Or write to Carrier Corporation, Syracuse, New York.

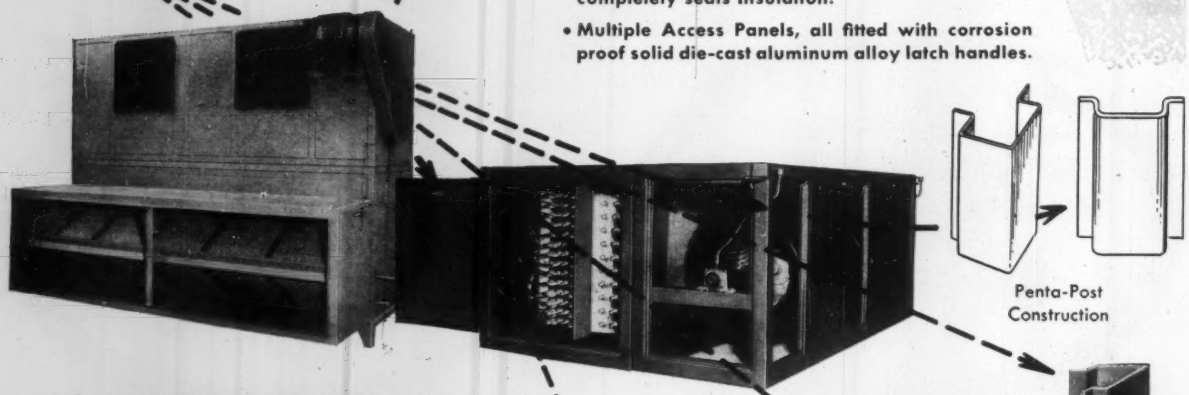
KENNARD Engineered AIR CONDITIONING

BLOWER UNITS

give you full value

Plus

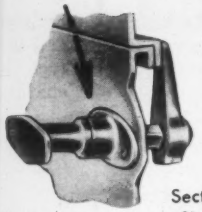
- **Penta Post Frames (gives strength to spare). Test as shown by Independent Testing Laboratory.**
- **Drain Pans—double metal pan under coil section completely seals Insulation.**
- **Multiple Access Panels, all fitted with corrosion proof solid die-cast aluminum alloy latch handles.**



Penta-Post Construction

Air Conditioning Blower Units. Vertical Floor Type and Horizontal Units. 13 sizes—300 to 21,600 CFM—**Catalog AC-1.**

Section thru showing double drain pan



Section of Panel Showing Latch

EVERY KENNARD REPRESENTATIVE was selected for his know-how and ability to help you solve your air conditioning problems. He's probably your neighbor—Phone him today.

KENNARD SHELL AND TUBE LIQUID CHILLERS

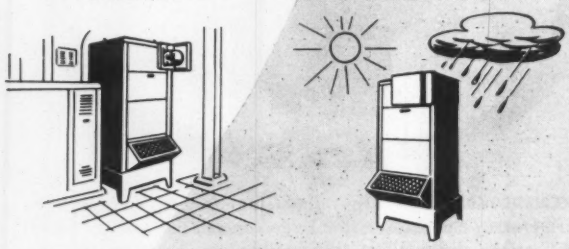
Direct Expansion
Freon 12-22

Revolutionary internally finned tubing makes them better than 50% lighter and smaller—positive oil return—no Freon head gasket (exclusive with KENNARD) — smaller Freon charge. Sizes 2 to 200 tons. **Catalog LC-1.**

KENNARD KT WATER SAVERS

(Induced Draft Cooling Towers)

INDOOR OUTDOOR

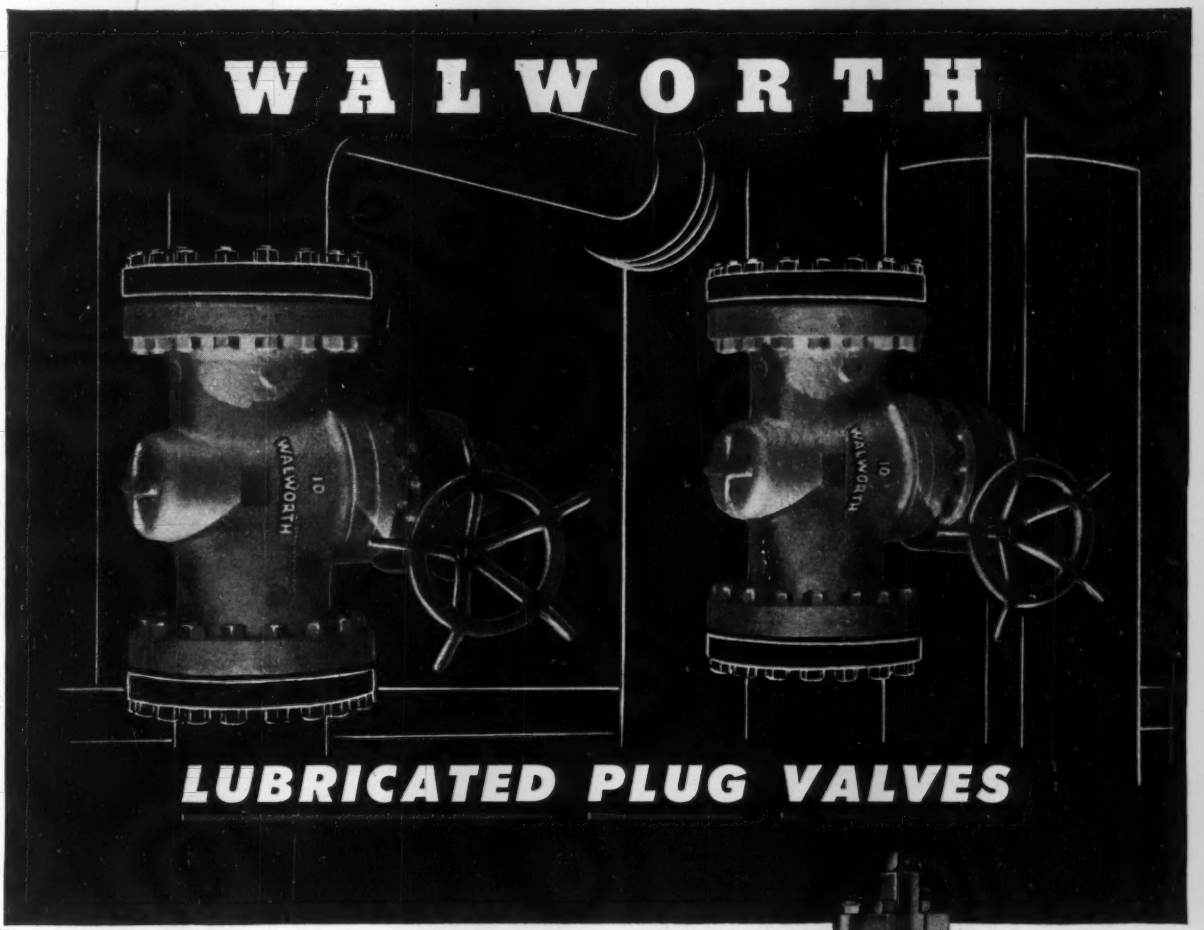


Centrifugal type fan, redwood wetted deck. 5 popular sizes 3, 5, 8, 11 and 16 Tons.

Catalog KT-2.

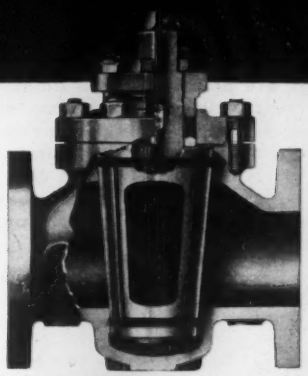
KENNARD CORPORATION • 1817 S. HANLEY ROAD ST. LOUIS 17, MO., U.S.A.

WALWORTH



LUBRICATED PLUG VALVES

Better because ... **They are *pressure sealed* with an insoluble lubricant readily renewed while the valve is in service. Lubricant completely surrounds the plug ports assuring a tight seal against leaks. It also insures ease of operation by reducing friction between the body and the plug while at the same time protecting the finished surfaces against corrosion and wear.**



Lubricant system of a Walworth No. 1700F Regular Gland, Wrench Operated, Steel-iron, *Lubricated Plug* Valve. Other Walworth *Lubricated Plug* Valves include Single Gland, and Ball Bearing types. Sizes to 30-inches — pressures to 5,000 psi, and for vacuum service.

Walworth Lubricated Plug Valves are the most satisfactory valves available for the handling of gritty suspensions, and many other destructive, erosive, and corrosive industrial and chemical solutions.

They are ideal for general refinery and pipeline service.

For full information see your Walworth Distributor, or write for your copy of Bulletin 111. Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

WALWORTH

Manufacturers since 1842

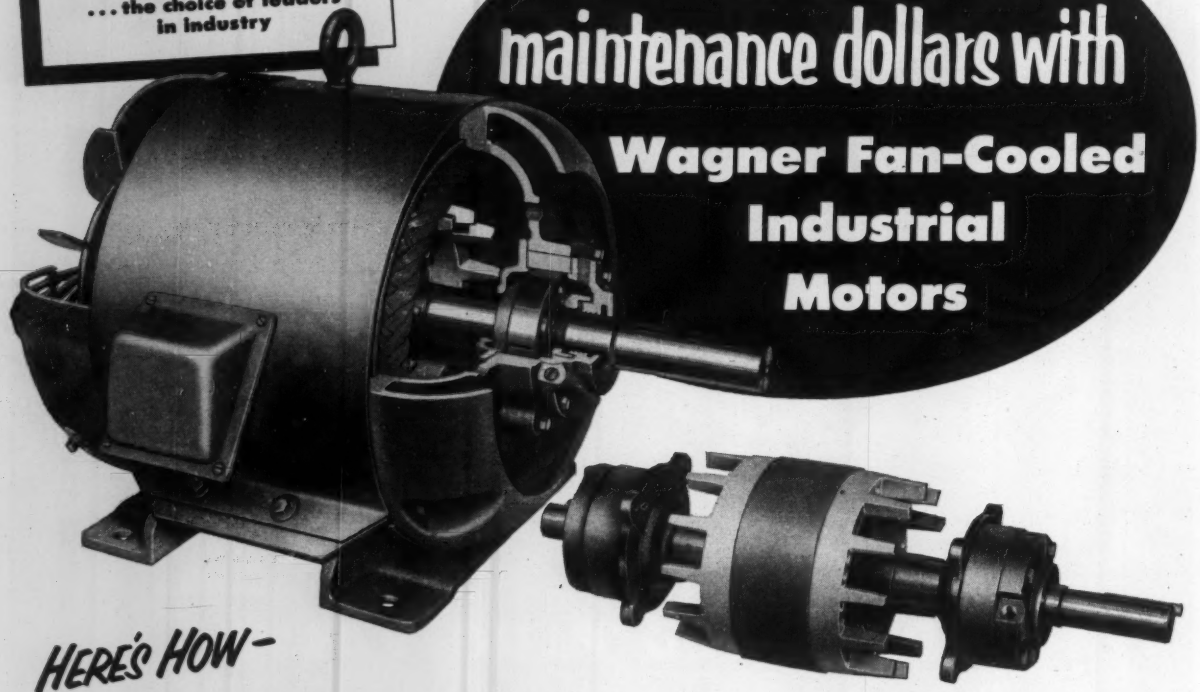
valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

Wagner®
ELECTRIC MOTORS
... the choice of leaders in industry

SAVE maintenance dollars with Wagner Fan-Cooled Industrial Motors



HERE'S HOW—

the Wagner Cartridge Bearing Design cuts your maintenance costs:

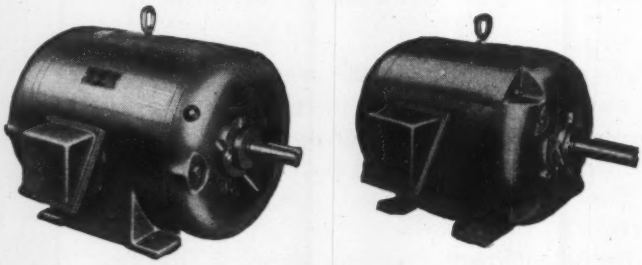
Bearings are protected at all times. The Wagner design completely encloses the bearings in a sealed cartridge. Labyrinth seals prevent the entrance of water, dirt and other foreign material. Even when the motor is disassembled, the cartridge remains intact as part of the rotor shaft. The bearing housing stays completely enclosed for full protection against dirt and dust.

Wagner Bearings can be relubricated. When lubrication is necessary to forestall premature bearing failure in unusually severe applications, readily accessible lubrication openings permit addition of grease or complete relubrication.

Wagner Bearings run longer between grease periods. Hot bearings shorten grease life. Wagner bearings have a low temperature rise because the design incorporates a deflector shield that directs a cooling stream of air around the bearing housing. Bearings run cooler and longer between maintenance periods.

This cartridge bearing design is a feature of the entire Wagner line of totally-enclosed fan-cooled motors. The line includes standard and explosion-proof steel frame motors, and standard and explosion-proof cast iron frame motors. All types are available with normal torque or high torque characteristics, in ratings to 250 hp.

For complete information—just call the nearest of our 32 branch offices, or write for Bulletins MU-132 and MU-196.



Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6370 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC

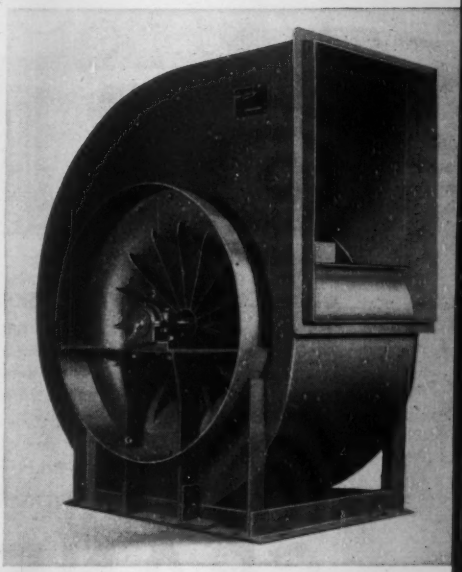
154-16

Sh-h-h

GET YOUR AIR NOISE LEVEL DOWN WITH "HUSH-A-BYE" QUIET "BUFFALO" TYPE "BL" FANS

One way to reduce your noise level is to select quiet fans.
And now, as never before, you can enjoy almost unbelievable quiet with the new "Buffalo" Type "BL" Fan.
Streamlined air movement through "Buffalo's" fixed inlet vanes and new backward curved blade wheel results in high efficiency, superb smoothness and quietness.
It's another example of the "Q" Factor* which has long made "Buffalo" your best fan buy.
Why not investigate this superbly performing fan today?
Write for Bulletin F-100.

**The "Q" Factor — The built-in Quality which provides trouble-free satisfaction and long life.*



"Buffalo"

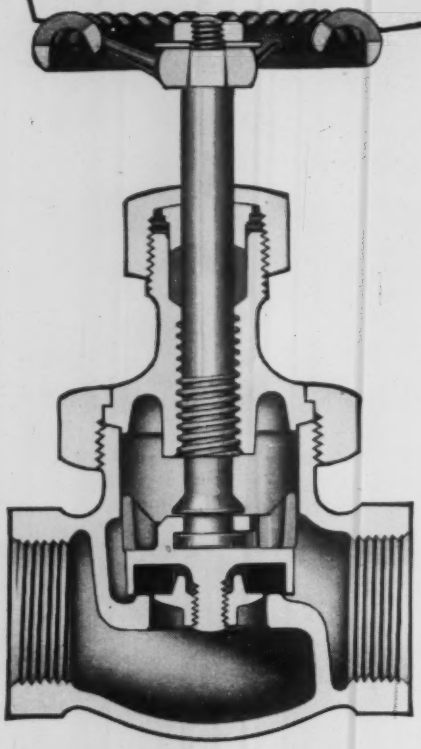
BUFFALO FORGE COMPANY
171 MORTIMER ST. BUFFALO, N. Y.

Publishers of "Fan Engineering" Handbook

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.
Sales Representatives in all Principal Cities

VENTILATING PRESSURE BLOWING AIR CLEANING COOLING AIR TEMPERING HEATING INDUCED DRAFT FORCED DRAFT EXHAUSTING

A New Disc . . .
A "New" Valve



Crane No. 7 Brass Valves with quick-change composition disc

Save time, trouble, and money by standardizing on these Crane quality 150-Pound Valves. Simple to service. No big inventory of replacement parts. Just a few extra disc holders . . . a supply of composition discs. That's all you need for a wide variety of fluids . . . and an economical maintenance program.

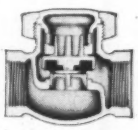
The composition disc takes most of the normal wear—stands up well under ordinary usage—seats easily even on air and gas—absorbs foreign particles that might cause leakage in metal disc valves. When a leak shows up, make a "new" valve—with a new disc. Simply dismantle the union ring, lift out the trimmings, replace the disc holder assembly. Takes only a few minutes. Save the disc holder you removed—use it with the next replacement disc.

Rugged construction throughout. Sturdy bonnet joint, well reinforced by heavy union ring—can be repeatedly dismantled and reassembled. Get better acquainted with the Crane No. 7 line . . . for steam, hot and cold water, air, oil, gas, gasoline, and many other fluids.

No. 7 Globe
Sizes ⅛ to 3-inch

No. 7 Angle
Sizes ⅛ to 3-inch

Specify No. 9 for Flanged Ends



No. 27 Check
Sizes ¼ to 3-inch

GLOBES, ANGLES, AND CHECKS

Ask for folder AD-1682R—contains full facts on the No. 7 brass valve line and the companion No. 27 check. Your Crane Representative has a copy for you—or write direct to address below.

THE BETTER QUALITY . . . BIGGER VALUE LINE . . . IN BRASS, STEEL, IRON

CRANE VALVES

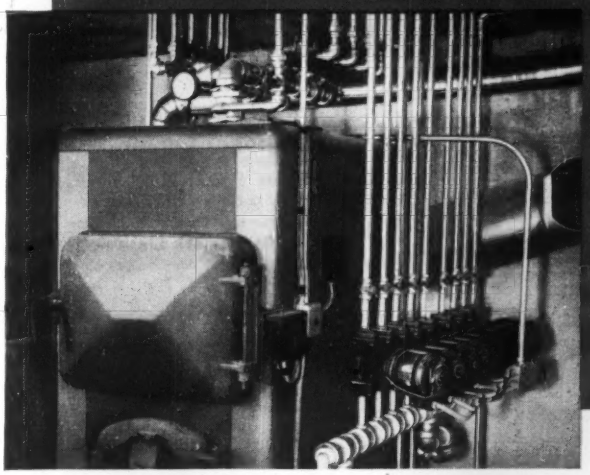
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

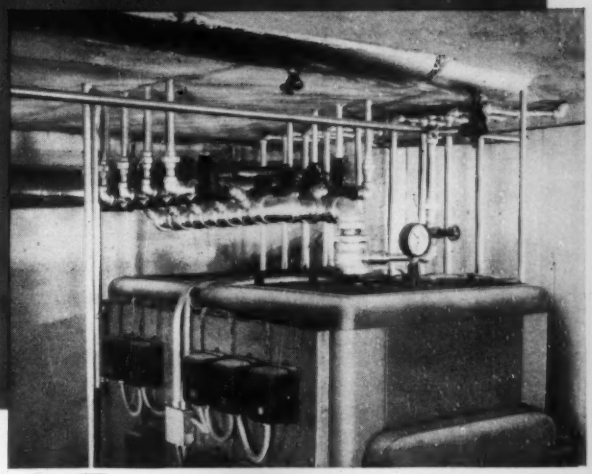
EVERY TENANT HIS OWN WEATHER-MAKER

B & G *Hydro-Flo* Heating

provides individual temperature control for each of nine apartments



Nine B & G Boosters, individually controlled by room thermostats, circulate hot water to each zone.



B & G Flo-Control Valves, installed in the supply mains, prevent an override in temperature when the Boosters shut off.

For QUIET operation and long, trouble-free life, you can depend on the B & G Booster. Send for Bulletin DG-950—see the reasons why this pump is the biggest seller in the field.

Some like it warm, some like it cool…but in this apartment building, B & G *Hydro-Flo* Heating keeps everybody happy. Each tenant can have the temperature considered most comfortable—*and raise or lower it at will!*

The building is divided into nine zones, each equipped with a thermostatically controlled B & G Booster and a B & G Flo-Control Valve. Economy of operation as well as comfort is achieved, since zoning permits compensation for differences in exposure, solar effect and temperature preference.

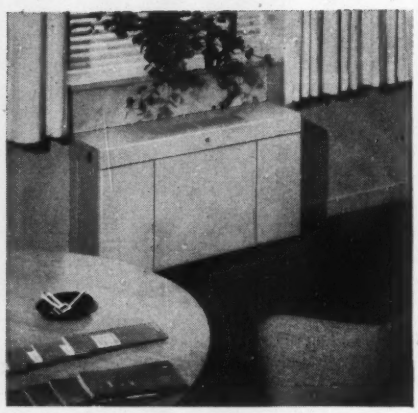
When you install a B & G *Hydro-Flo* Forced Hot Water System, you've laid the groundwork for the most modern comforts and conveniences. You've provided better heating …uniform temperature—warm floors—draftless rooms. You've assured fuel economy and the convenience of low-cost, all-year domestic hot water. Snow-melting and summer cooling equipment can be added at any time.

Send today for catalog of B & G *Hydro-Flo* Products.

BELL & GOSSETT
COMPANY
Dept. DN-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto, Canada

*Reg. U. S. Pat. Off.



The Carnegie Endowment International Center

United Nations Plaza, New York. **Architects:** Harrison & Abramovitz; **Mechanical Engineers:** Syska & Hennessy; **General Contractors:** Caldwell-Wingate Co.; **Heating & Air Conditioning Contractors:** J. L. Murphy, Inc.

How to air condition an 11-story building *that's only 10 stories tall*

THERE is a trend toward lower ceiling heights, to reduce building costs and make rooms look "friendlier." Following this movement, the Carnegie Endowment International Center has low 9-foot ceilings. As a result the 11-story building was fitted in a normal 10-story building shell.

Low ceilings, however, create air conditioning problems. They cannot be furred down to hide the ductwork necessary for most air conditioning systems. *But, the American-Standard Remotaire system does not require bulky ducts.* One pipe carries chilled or hot water from a centrally located plant to each individually controlled Remotaire unit in the building.

Remotaire units condition the air through 4-row coils, and circulate it through the room. They filter and blend room air and fresh air.

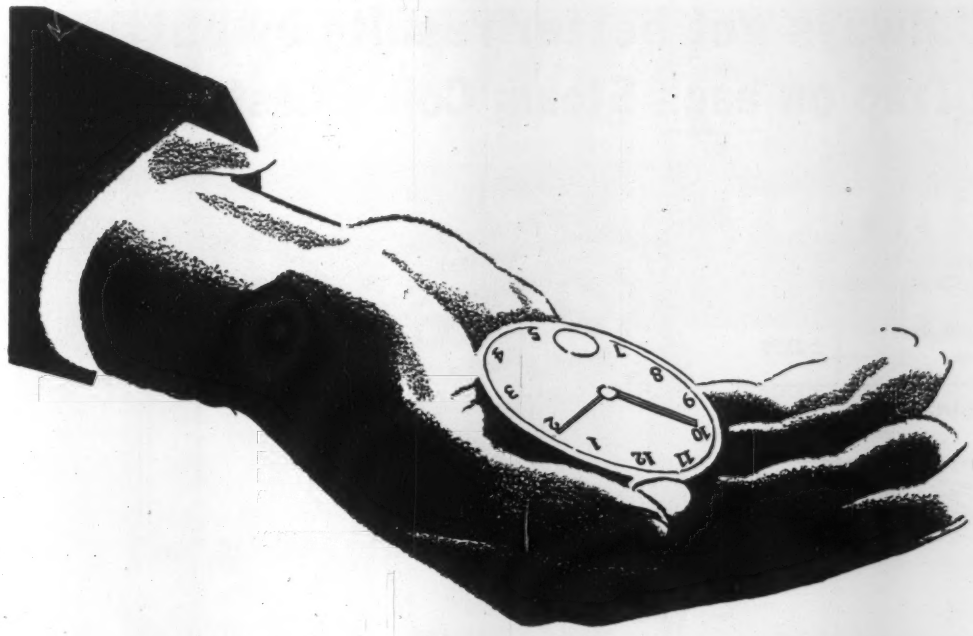
Remotaire units come in 200, 400 and 600 cfm capacities. They can be recessed in the wall, either completely or partially, or left free-standing. Handsome steel jackets can be painted if desired.

Installation and maintenance of Remotaire units is easy. Plenty of wrench space is provided to make pipe connections. Motor and fan assemblies can be removed as a unit. Coils can be reversed for left or right-hand connection.

For more information about Remotaire send for descriptive literature . . . Form 417. **American Radiator & Standard Sanitary Corp.,** Dept. HP-84, Pittsburgh 30, Pa.

AMERICAN-Standard
WATER HEATING-COOLING SYSTEMS

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



for *Fast, Dependable* Service...

Call Your Republic Pipe Distributor

● His operation is geared to handle rush orders. A phone call will usually speed his truck on its way in a matter of minutes.

Of course, if you can anticipate your requirements, he'll appreciate the advance notice—but he's prepared for emergencies. That's because he carries pipe in all sizes and lengths—plus fixtures, controls, tools and other items—for every type of installation.

So why worry about maintaining a large piping inventory? Make his stockroom your stockroom. You save capital investment. You save handling costs and insurance. You save valuable storage space.

Get to know your Republic Pipe Distributor and the top-quality materials he stocks. At this very moment he's as close as your telephone . . . and he'll be glad to hear from you.

- Easy to bend, thread, and close coil
- Easy to weld by all methods
- Uniformly ductile
- Uniformly strong
- Uniformly clean and scale-free
- Uniform wall thickness, diameter, concentricity
- Economical uniform lengths, extra long lengths

REPUBLIC STEEL

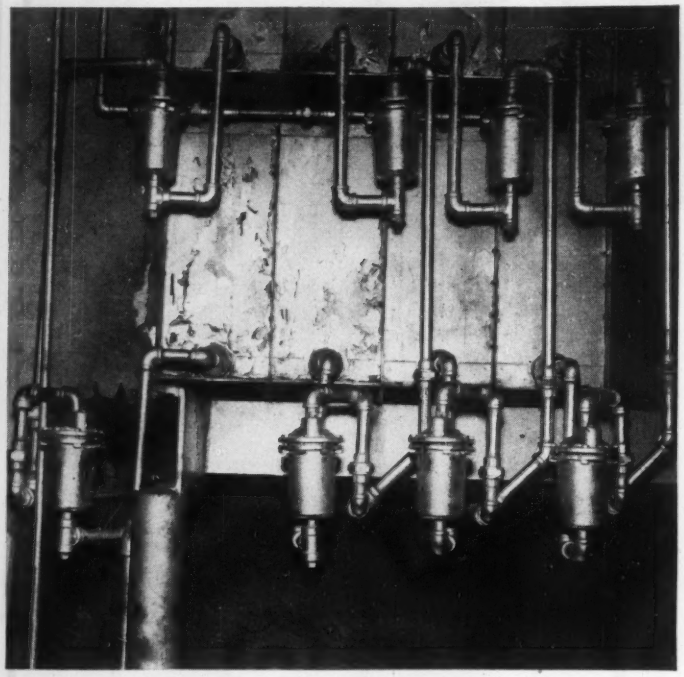
REPUBLIC STEEL PIPE

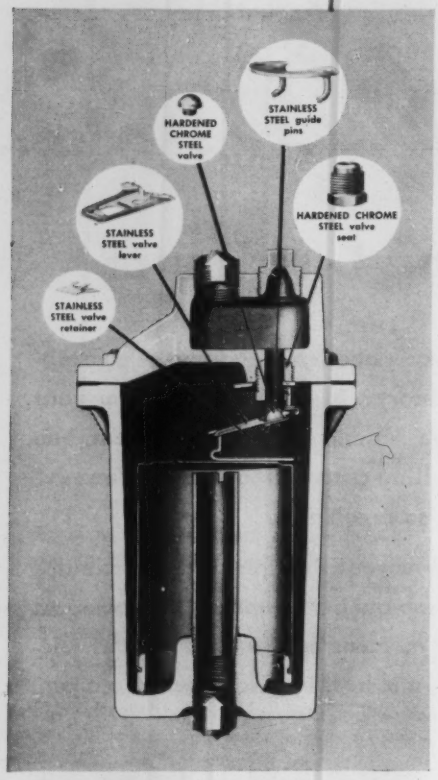
You will always get better results by putting a Steam Trap on each Steam Coil, Chest or Unit

EXAMPLE

Dryer Temperatures at
Guelph Creamery, Guelph, Ontario.

WITH GROUP TRAPPING (5 steam traps for 10 coils)	**225°F**
WITH BLOW-THROUGH (no steam traps)	**250°F**
WITH ARMSTRONG UNIT TRAPPING (10 traps—one on each of 10 coils)	**309°F**




HARDENED CHROME STEEL valve
STAINLESS STEEL guide pins
STAINLESS STEEL valve lever
HARDENED CHROME STEEL valve seat
STAINLESS STEEL valve retainer

One of the big advantages of Armstrong traps is LOW MAINTENANCE. Mechanisms in low and medium pressure traps identical in design, workmanship and materials to those in 900°F, 900 psig traps.

● The example at the upper left is simply one of thousands that bear out the benefits of "Armstrong *Unit* Trapping".

When you analyze it, the reason is quite obvious. No two steam coils, chests, chambers or machines will condense steam at exactly the same rate under operating conditions. There is a greater pressure drop in the units that condense the fastest. Steam will backflow through a common drain line from a higher pressure unit to a lower pressure unit. This blocks off flow of air and retards condensate flow from the lower pressure unit. On the other hand, if you separate each unit with its own trap, that can't happen.

You will *always* get higher temperatures and lower production costs with unit trapping. Ask your Armstrong Representative about it, or write:

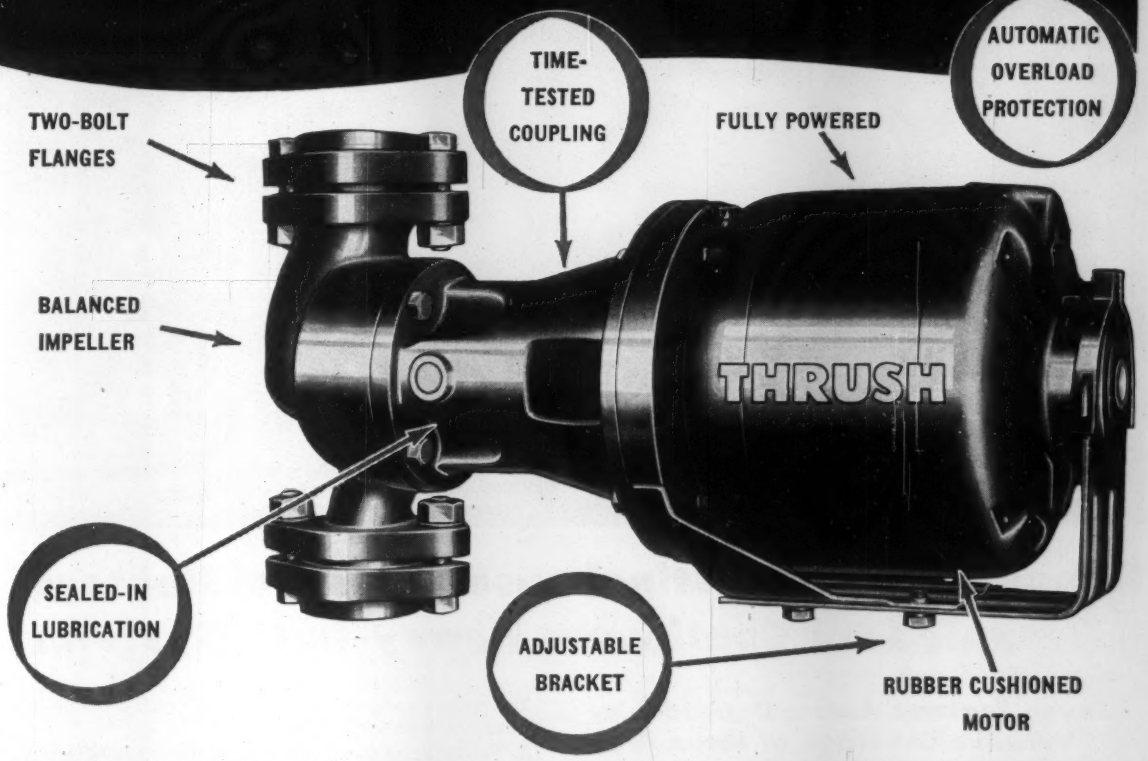
ARMSTRONG MACHINE WORKS
874 Maple Street, Three Rivers, Michigan

FREE—STEAM TRAP BOOK

If you don't have a copy of the 44-page Armstrong Steam Trap Book, we'll be glad to send you one. No obligation.

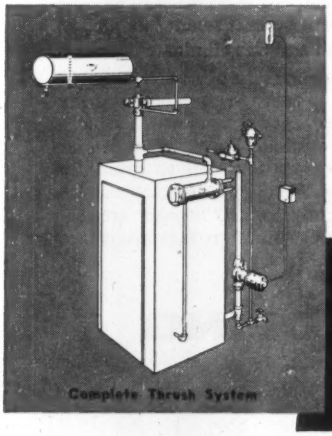
ARMSTRONG STEAM TRAPS

IMPROVED! to give you more Circulator for your money



QUIETER • GREATER CAPACITY • RUGGEDLY BUILT • COMPACT

FOR REAL dependability and fine performance choose Thrush Water Circulators. Time-tested design, improved in efficiency, increased in capacity, with job-rated power for each size . . . Thrush offers the greatest value per dollar in Circulators today.

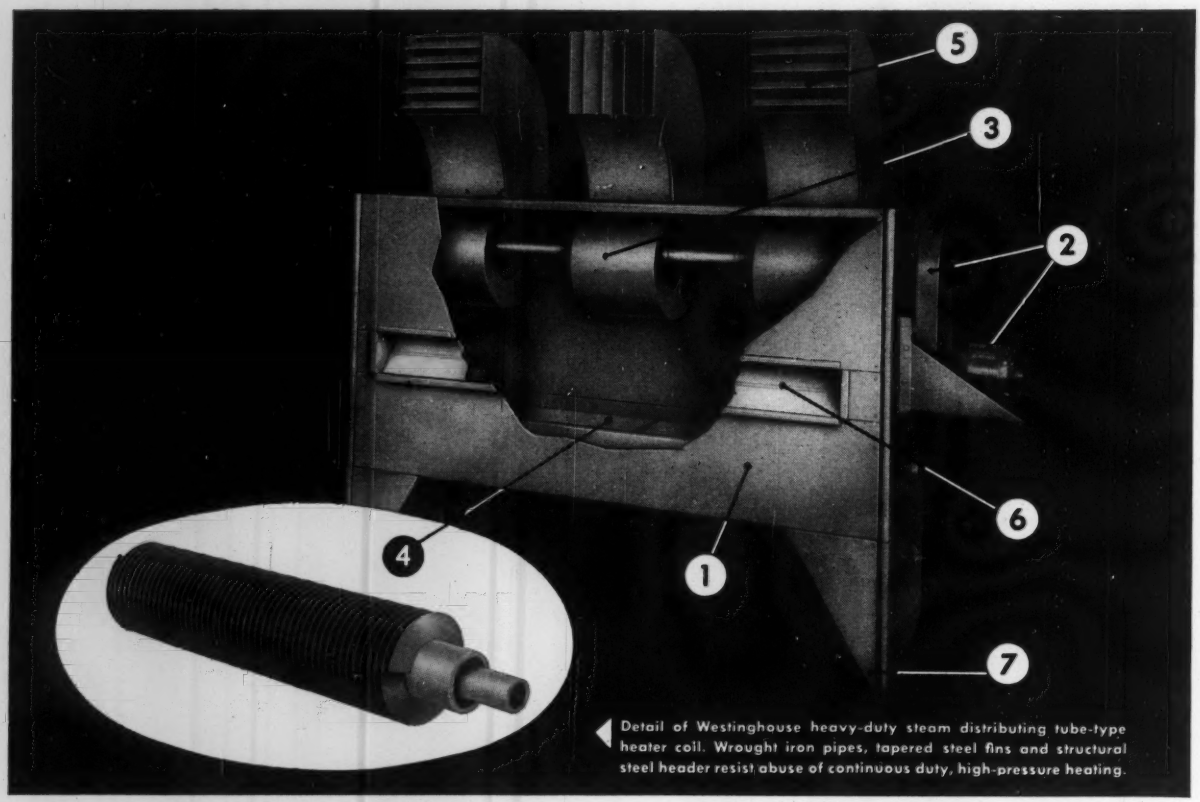

Complete Thrush System

The rubber-cushioned motor mounting eliminates noise and vibration. The adjustable bracket makes motor change easy. The patented spring coupling transmits power evenly. It's trouble-free. Lubrication is sealed in . . . with double seals that rarely if ever need replacement.

See your wholesaler today or write Dept. E-8.

H. A. THRUSH & COMPANY • PERU, INDIANA

THRUSH Water Circulators



Detail of Westinghouse heavy-duty steam distributing tube-type heater coil. Wrought iron pipes, tapered steel fins and structural steel header resist abuse of continuous duty, high-pressure heating.

Rugged, Quiet Westinghouse Industrial Heaters... Designed For Continuous Heavy-Duty Systems!

Seven Features Assure Dependable, Versatile Coverage of Large Areas

Westinghouse Industrial Heaters supply ideal heat under difficult conditions. In plant, warehouse, garage and similar buildings, these heaters efficiently blanket large work zones, even those with high ceilings, frequently opened doors and expansive window areas. They also supply make-up air for exhaust systems . . . may be used to circulate ventilating air during warm seasons. Capacities in six sizes range up to 2,500,000 BTU/hr . . . 25,000 cfm . . . 200 psig steam pressure.

Each Westinghouse Industrial Heater is a complete unit. That's why each can be placed where it will do the most good . . . whether on floor, or wall (upright or inverted), or suspended from ceiling. Economically selected and scientifically grouped, Westinghouse Industrial Heaters satisfy the needs of areas of any size or shape, and can be readily relocated to suit plant layout changes.

Westinghouse Industrial Heaters have a line-up of features that is unique:

1. Casings are rugged heavy-gauge steel. Front and back panels are easily removed.
2. Standard motors have adjustable V-belt drive on units with motors up to 5 HP.
3. Powerful, yet quiet, fans are multiblade centrifugal type mounted on a common shaft. Blades are forwardly curved.
4. Efficient steam coils are heavy-duty or general purpose. Former are wrought iron for extra-long life (see detail shown above); latter are standard or steam distributing copper-tube type.
5. Discharge outlets and deflectors permit flexible discharge arrangements. Result: most advantageous airflow and heat distribution pattern.
6. Bypass damper arrangement permits constant air modulation. Standard arrangement permits steam modulation.
7. Rounded corners, smooth surfaces eliminate accidents, minimize dirt.

These features are backed up with a Westinghouse-Sturtevant exclusive—a single equipment warranty with undivided responsibility. This unit responsibility is your greatest guarantee of dependable performance for years to come. For complete details call on the Westinghouse-Sturtevant air handling specialist conveniently located in your area. Or write: Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

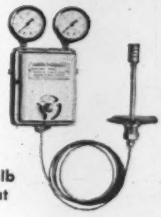
WESTINGHOUSE AIR HANDLING

YOU CAN BE SURE...IF IT'S Westinghouse

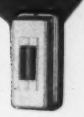
J-80412

V-103
Coil Valve

D-251
Piston Damper
Operator



T-800
Remote Bulb
Thermostat



T-400
Room
Thermostat

C. A. Norgren Co., Englewood, Colorado. Stanley Morse, architect; K. J. Murray, consulting engineer; Bell Plumbing & Heating Co., heating contractor, all of Denver.

One of the most modern manufacturing and office buildings recently constructed in the Denver area is the C. A. Norgren Co. building at Englewood, Colorado.

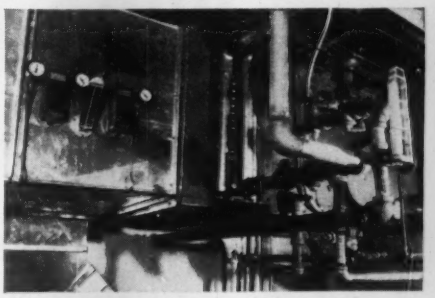
Precision regulation of the heating and air conditioning systems is provided by a specially planned system of Johnson Automatic Temperature Control. The building is heated by radiant panels and convectors. Room by room comfort is assured by strategically located Johnson *Individual Room* Thermostats which operate valves on the water supply to the panels and convectors.

Behind the scenes, other Johnson Thermostats operate Johnson Valves and Damper Operators on the four central fan heating and air conditioning systems which serve the executive, sales and general offices, the engineering department and the lobby area.

All control apparatus is combined in a single "Planned-for-the-Purpose", "Installed-for-the-Purpose" control system resulting in maximum comfort and savings from every heating and cooling dollar spent.

Johnson Automatic Control Systems are always designed specifically for each individual installation. Let a Johnson engineer from a nearby branch office provide the answer to your temperature regulation problems. There is no obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

In the engineering department, Johnson *Individual Room* Thermostats maintain ideal working temperatures by operating convector valves and regulating the supply of conditioned air.

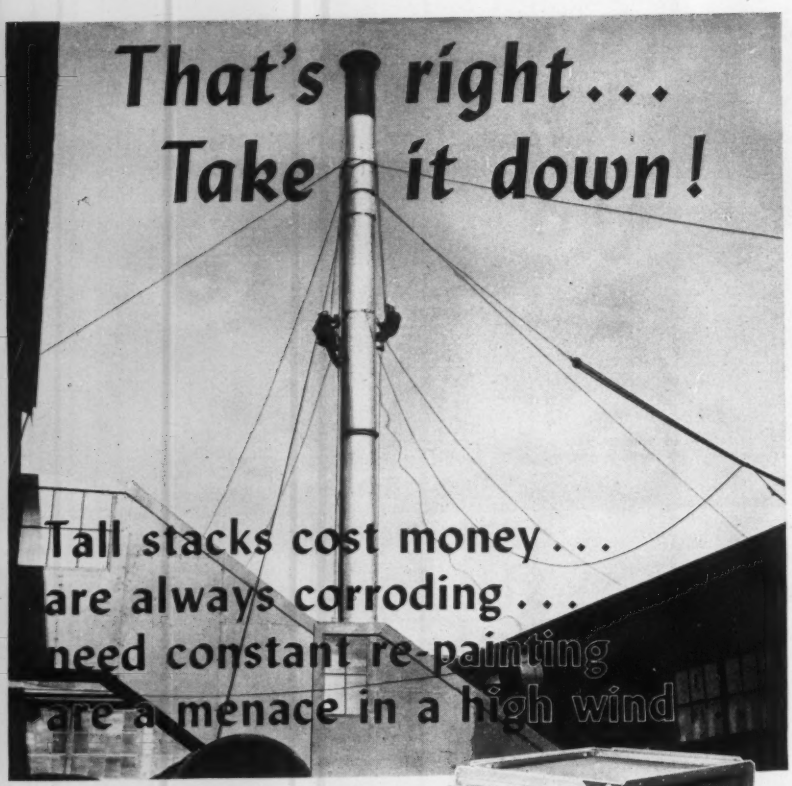


Johnson Thermostats on one of the central fan air conditioning units regulate the fresh air supply and control the temperature of the conditioned air. The thermostatically controlled steam valve provides a constant discharge temperature in the heating season.

JOHNSON CONTROL

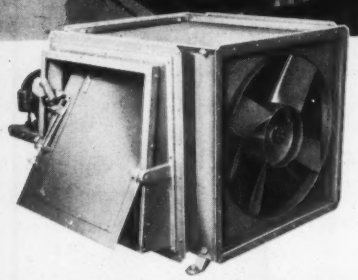
TEMPERATURE ⇕ AIR CONDITIONING

MANUFACTURING • PLANNING • INSTALLING • SINCE 1885



REPLACE

with



WING DRAFT INDUCERS

Insure adequate draft at all times. Will pay for themselves in a few years on fuel savings alone.

Write for Bulletin

L. J. Wing Mfg. Co.

140 Vreeland Mills Road
Linden, N. J.

Factories at Linden, N.J. and Montreal, Canada

OUR 75TH YEAR

Wing

SEVENTY-FIVE YEARS AGO

The high wheel bicycle was all the rage in 1879, the year L. J. Wing founded the company that now bears his name. Mr. Wing's prolific talents in mechanical invention were largely in the fields of ventilation and combustion, although he also was interested in electric motors, gasoline engines, etc. The first disc propeller fan, the small steam turbine and the turbine blower were all valuable contributions of L. J. Wing to industry.

"We've got an economy drive going..."

"Wow! Am I glad to get off my feet. Those cement floors at the exhibit hall were killing me!"

"Glad to have you stop by. Let's just relax for awhile."

"While we're sitting here, Roy, tell me something. I heard you talking about cutting costs with that fellow from the automobile plant. We've got an economy drive going and I'd like some more ammunition. For example: Wolverine Trufin*—why is that so economical?"

"Trufin is a natural for cutting costs. One-piece construction gives you more heat transfer area in less space. Retubing with Trufin saves the cost of new equipment, boosts output."

"It sounds better all the time, Roy. Keep going."

"Well, we've got the Wolverine Spun End Process†. We take a length of plain tube and, in one simple operation, fabricate it into the shape you need. Spinning can eliminate such operations as deep drawing, swaging, machining and assembly."

"That can save us plenty of time."

"Sure, Bill. You're an engineer—you've got to look at it that way. And you, Jim,—you're a P.A. You've got to consider convenience. You'll be interested in knowing that Wolverine produces tubing of copper (and its alloys), aluminum, and electric-welded steel—prime surface or finned. Then, too, we can give you production-line packaging—safe delivery, easy to handle, easy to store shipments. Remember too, Bill, that you can get technical help from our Field Engineering Service!"

DON'T FORGET: Only Tubemanship can produce such a sparkling economy story as this. You can get full information from our General Products Catalog. Just write. WOLVERINE TUBE, Division of Calumet & Hecla, Inc., 1461 Central Avenue, Detroit 9, Michigan.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

† A PATENTED PROCESS RE. 22465
* REGISTERED U.S. PATENT OFFICE

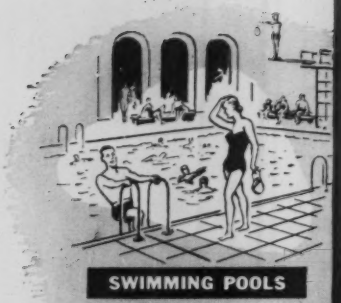
EST. 1916

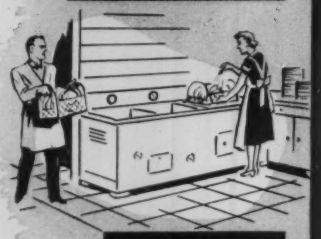
WOLVERINE TUBE

DIVISION OF CALUMET & HECLA, INC.

Manufacturers of Quality-Controlled Tubing

PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES.
EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK


SWIMMING POOLS


DISHWASHERS

SHOWERS

Fast, Dependable Action from ADSCO WATER HEATERS

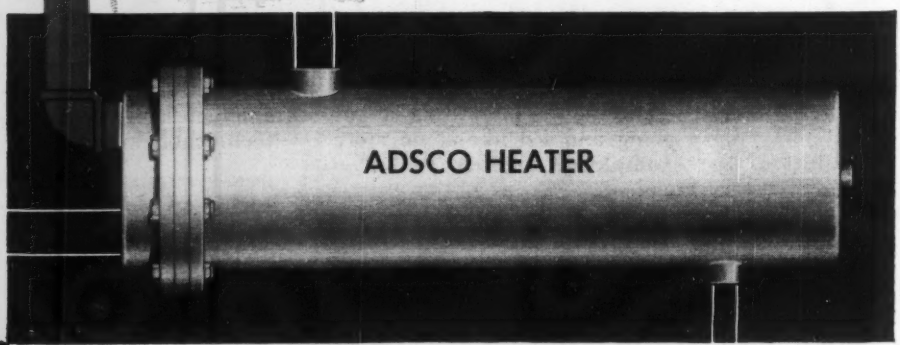
SPACE HEATING

WASH ROOMS

LAUNDRIES

Hot water! Plenty of hot water! When and where you want it... and at low cost! ADSCO Water Heaters are dependable sources of hot water in any type of plant or building wherever there is a steam supply. Use ADSCO Water Heaters for space heating, for process hot water, or for such general service as showers, laundries, dishwashers, swimming pools...even for snow melting. Write today for Bulletin 35-77 on Convertors, or Bulletin 35-78 on Instantaneous Heaters.

Where storage heaters are needed, write for ADSCO Bulletin 35-75.



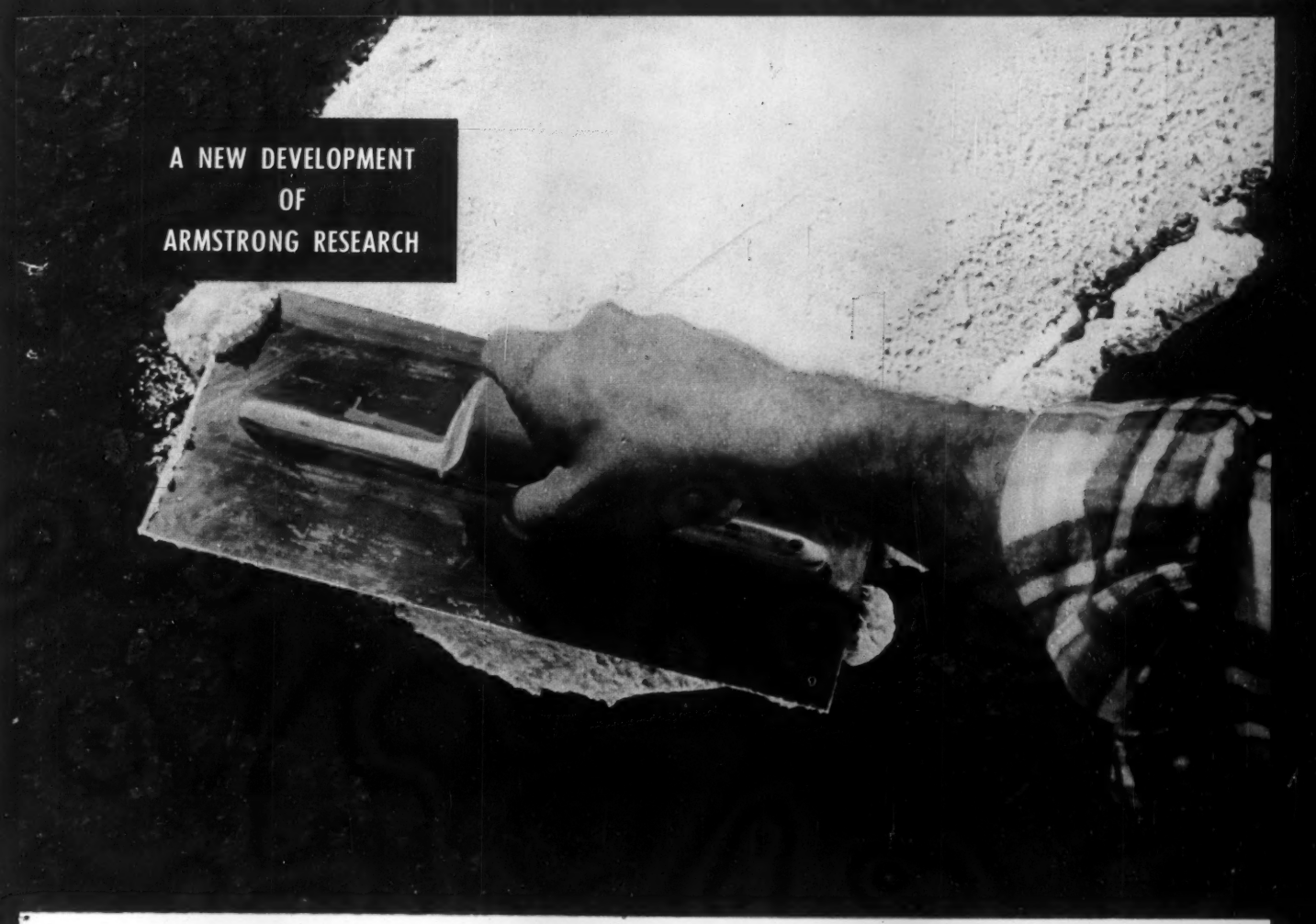
ADSCO ENGINEERED PRODUCTS

AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
NORTH TONAWANDA, NEW YORK
PLANTS: NORTH TONAWANDA, N. Y. — RICHMOND, CALIF.

FOR THE DISTRIBUTION AND UTILIZATION OF STEAM, LIQUIDS AND GASES

EXPANSION JOINTS · SEPARATORS · METERS · STEAM TRAPS · STORAGE HEATERS · STRAINERS



MONOPLAST . . . *a new, one-coat insulation finish for cold room walls and ceilings*

Monoplast is an entirely new, light-reflective white finish for cold rooms. Trowelled on in just one coat, it dries to a durable surface for all temperatures to 80° F. below zero. Monoplast reflects 72% of the light that strikes its surface, resulting in an exceptionally bright cold room interior. Its resilience and strength protect the insulation from abrasion. Monoplast is easy to maintain.

A Monoplast finish is completely monolithic, with no score marks to mar its surface. It needs no painting and can be washed with water and commonly used cleaning agents. It weighs only about one-fifth as much as two-coat portland cement plaster and can be applied to ceilings as easily as to walls.

This new finish is available through Armstrong's Contract Service. It is one of the new products of Armstrong's research that are simplifying application methods in the industrial insulation field.

For full details on Monoplast and Armstrong's Insulation Contract Service, call the Armstrong office nearest you or write today to Armstrong Cork Company, 203 Stratton Street, Lancaster, Pennsylvania.

Applied by trowelling, one coat of Monoplast provides a tough, durable cold room finish that will last for many years. Armstrong's Monoplast eliminates the necessity of scoring and painting the walls.

ARMSTRONG'S INDUSTRIAL INSULATIONS

York brings new standards of comfort to modern air conditioning—and architects, building owners and managers are showing their approval by specifying York equipment for more and more buildings, old and new.

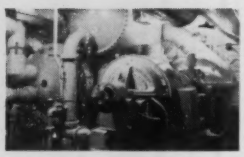
The Equitable Life Assurance Society Building is an example. This impressive structure will tower 25 stories skyward . . . the *first* large office building in San Francisco to have complete air conditioning.

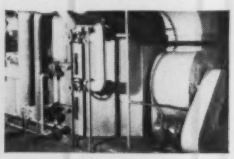
Naturally, the tremendous glass areas of this building presented a sizeable heat-load problem. York engineers—who have a wide range of systems from which to choose, who even design special systems to provide the *right kind* of air conditioning for unusual structures—are furnishing a Yorkaire Low-Pressure Induction Unit System as the perfect answer.

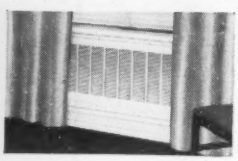
In homes and offices, ships and stores, skyscrapers, factories, hospitals, theaters . . . almost everywhere you go, when the air conditioning is just right, chances are it's York Air Conditioning . . .

. . . so a Yorkaire System of air conditioning was chosen, also, for San Francisco's newest skyscraper!

Beautiful new Equitable Life Assurance Society Building
Architects—Loubet and Glynn, Associates of the late W. D. Peugh of San Francisco
Consulting Architect—Irwin Clavan
General Contractors—Dinwiddie Construction Co. of San Francisco
Mechanical Contractors—Scott-Nelson of San Francisco







● Source of comfort cooling in the Equitable Life Assurance Society Building is a 600-hp York Turbo Water Cooling System. ● "Raw" air from outdoors is filtered, washed, cooled or heated, and moisture conditioned. When it's "just right for comfort," it's sent under mild pressure to you. Coils, on every fourth floor, maintain the coolness of the conditioned air. ● Room units (1177 in the Equitable Life Assurance Society Building) release the conditioned air in a gentle, quiet stream at the exact comfort needs of each office.

IF YOU ARE ABOUT TO AIR CONDITION—

Remember, York engineers brought the right kind of comfort cooling to such important projects as the Empire State Building, the S. S. United States, Cincinnati's Netherland-Plaza Hotel, Atlanta's Fulton National Bank, the Esso Standard Oil Company in Philadelphia and the Mile High Center in Denver. You can take advantage of York's wide range of equipment and experience by calling any York District Office (located in principal cities), or writing: York Corporation, York, Penna.

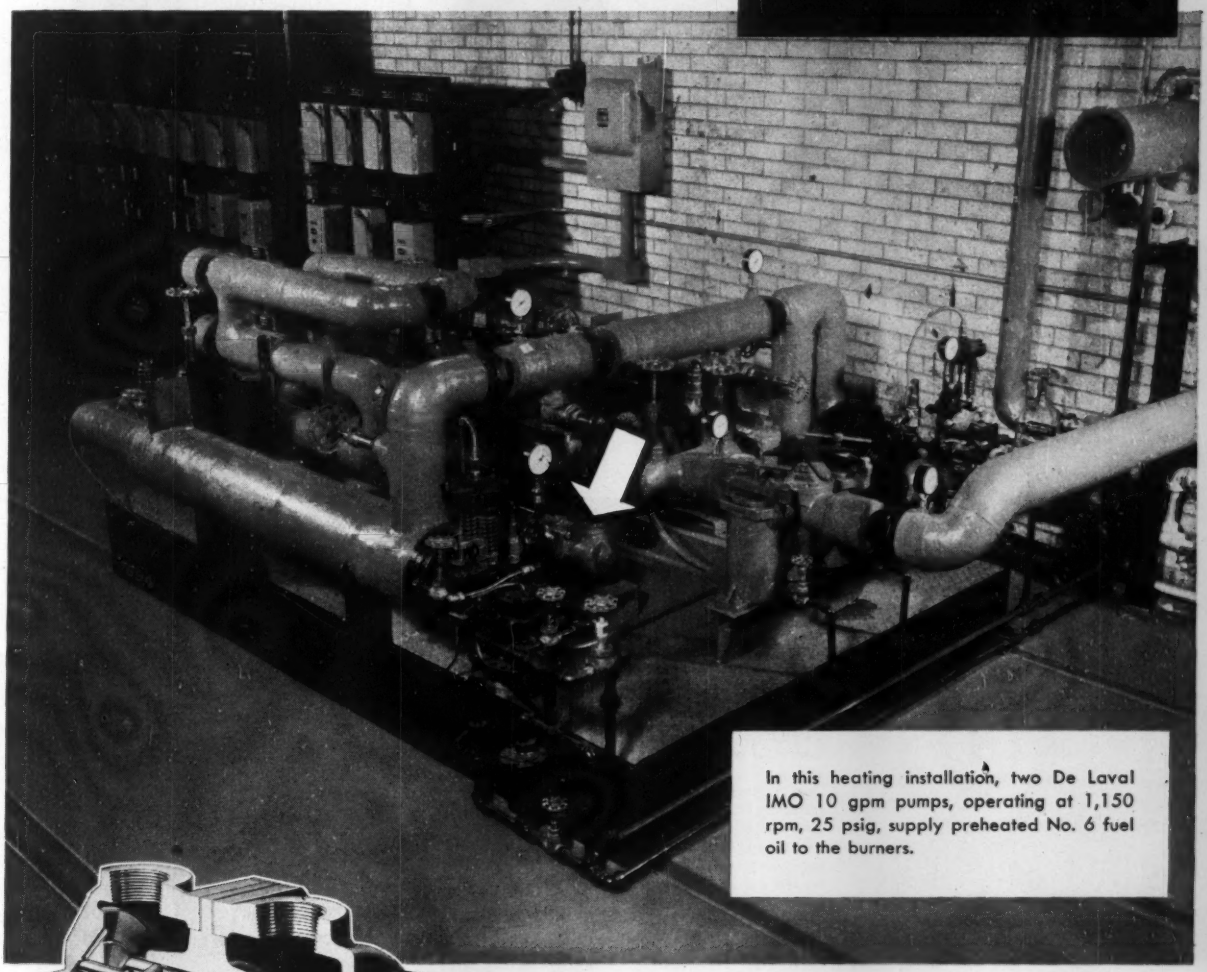
air conditioning by york

YORK CORP. York refrigeration air conditioning YORK, PA.

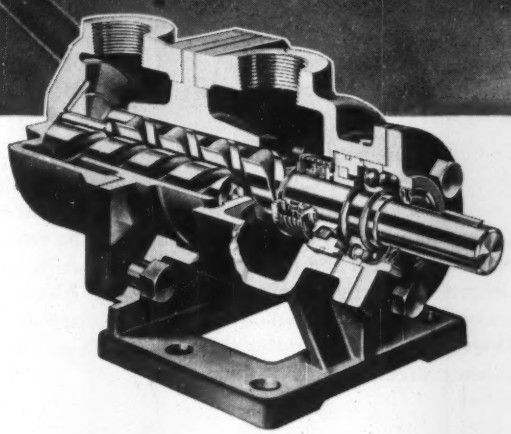
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

Contracts are more profitable when you install dependable

DE LAVAL
IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls. . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY

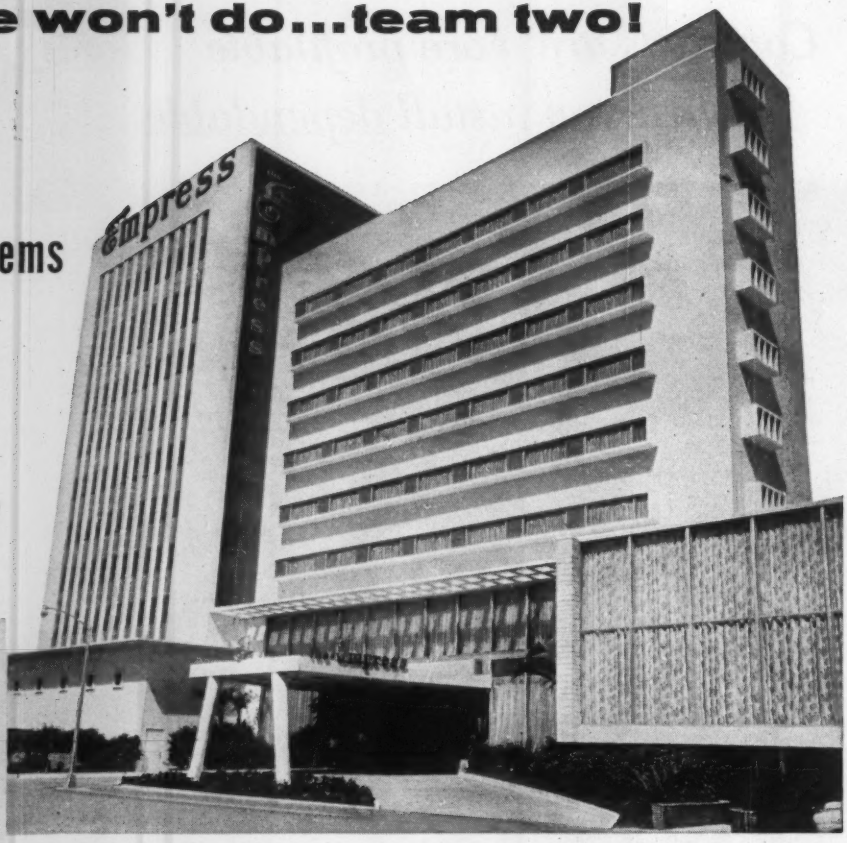
871 Nottingham Way, Trenton 2, New Jersey

DL272

where one won't do...team two!

Chrysler Airtemp Air Conditioning Combines 2 Systems

for best results in this new Miami Beach Hotel

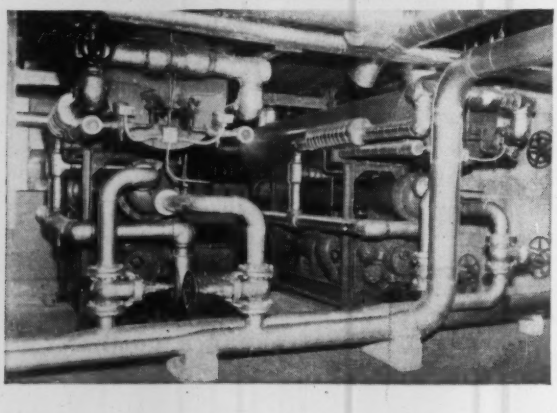


Chrysler Airtemp System of year 'round air conditioning serving rooms allows guests to select their own indoor climate at all times. When a room is not occupied, its air conditioning unit is turned off completely for economy.

In lobby, cocktail lounge, restaurant and other public rooms, a hotel must provide a comfortable atmosphere all year around. So a Chrysler Airtemp Central Duct System, with centralized control, was selected to supply conditioned air for these areas of the new Empress Hotel in Miami Beach. But to give guests complete control of the temperature in their own rooms, a system of individual air conditioning units was also employed. These concealed overhead units utilize chilled water in summer and warm water in winter.

Precision-built equipment for all types of air conditioning —one system or any specially-engineered combination of systems — is manufactured by Chrysler Airtemp in a modern, air conditioned plant. And to expedite the work of architects, engineers and contractors, Chrysler Airtemp offers a complete air conditioning service through Airtemp Construction Corporation, a wholly-owned subsidiary. Just write Airtemp Division, Chrysler Corporation, Dept. HP, 1600 Webster Street, Dayton 1, Ohio.

Three 100-H.P. Chrysler Airtemp "Packaged" Chillers dispatch chilled water to out-of-sight air conditioners in all guest rooms.



CHRYSLER AIRTEMP

HEATING • AIR CONDITIONING for HOMES, BUSINESS, INDUSTRY
AIRTEMP DIVISION, CHRYSLER CORPORATION
Dayton 1, Ohio

How Exon 402-A wipes out corrosion

Exact tolerances previously destroyed by corrosion

...are now kept micrometrically exact with

Boltaron 6200

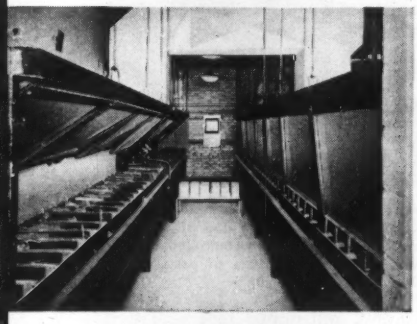
A 2-headed problem faced Norris-Thermador Co. of Los Angeles. They use large rings like stencils to plate copper onto kitchenware. Painfully exact tolerances are mandatory. But the corrosive solutions used ate away the tolerance, ruined rings, skyrocketed costs.

Engineers ransacked industry's resources for one material that could hold tolerance in so corrosive a solution. They found it in Boltaron 6200.

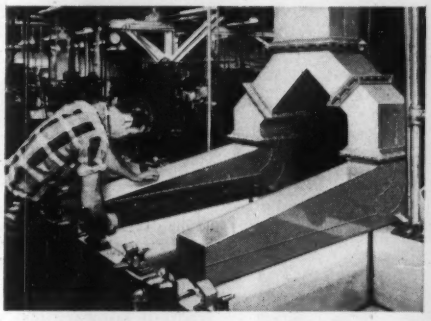
After a year, Boltaron 6200 rings show no sign of corrosion. Replacement costs? Wiped out!

Installation by Horace Blackman Co.

Photographs courtesy H. N. Hartwell & Son, Inc., Boston 16, Mass.

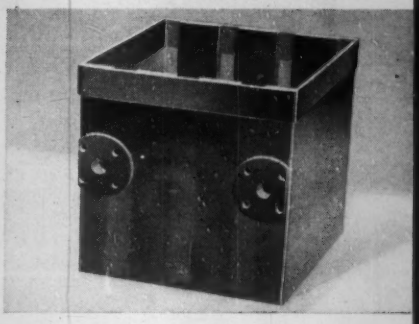


★ For 18 months, sulfuric acid fumes have failed to corrode a Boltaron fume removal system at Electric Storage Battery Company, Fairfield, Conn.



★ Maintenance costs were wiped out at Cannon Electric Co., Los Angeles. A metal-corroding solution of 33% nitric, 33% sulfuric acid and 33% fluoride salts has left Boltaron ducts and tanks unmarked for a year.

Installation by Horace Blackman Co.



★ Eastman Kodak Co., Rochester, reports that Boltaron 6200 remained completely uncorroded by ferricyanide after 3 years, when no other material lasted 3 months.

Installation by Industrial Plastic Fabricators, Inc.

New rigid, extremely versatile, light weight materials are making corrosion a memory in industry all over America. These unplasticized polyvinyl chlorides are typified by Boltaron 6200.

Firestone's Exon 402-A resin meets Boltaron's exacting specifications—best assurance of uniform results under the most corrosive conditions.

These materials can be welded, sawed, sheared, stamped, milled, molded, planed, drilled, embossed, rolled and cemented—on conventional woodworking or metalworking equipment.

For details that will interest you in particular, call or write:

Firestone

EXON

Chemical Sales Division

FIRESTONE PLASTICS COMPANY DEPT. 23B POTTSTOWN, PENNSYLVANIA. A DIVISION OF THE FIRESTONE TIRE & RUBBER CO.

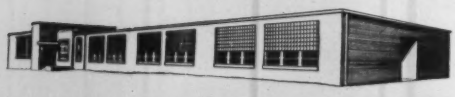
NOTE: Firestone supplies the resin only, does not manufacture the end product.

BARBER COLMAN

ELECTRIC

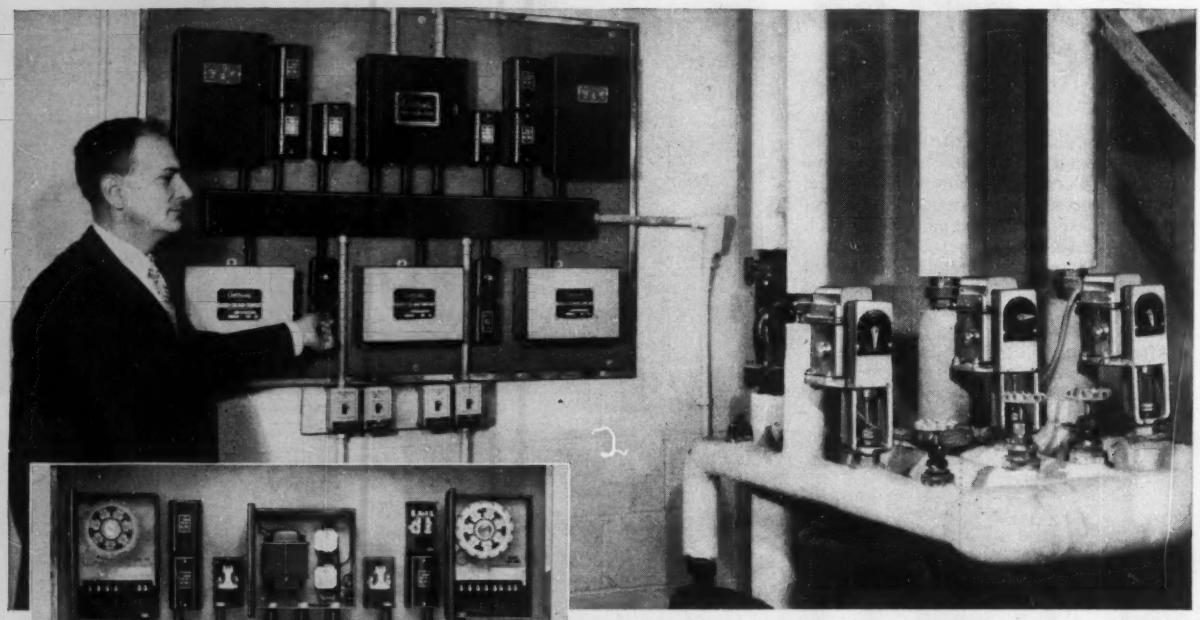
Control Center

...modern way to control heat in elementary schools

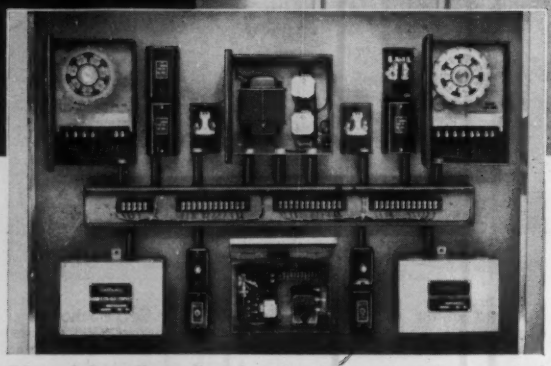


Today progressive engineers are standardizing on simplified, all-electric systems which provide newest features for accurate control at lower cost. For example, Marcus R. Durlach, Jr. has specified the Barber-Colman "Control Center" system for schools throughout the Southeast. In spite of rapid and wide variations of outdoor temperature in that region, the streamlined, modern control system provides even, comfortable heat throughout each building. Not only is the finished job more attractive and effective, but money is saved in purchasing equipment, installation, servicing, supervision, and operation.

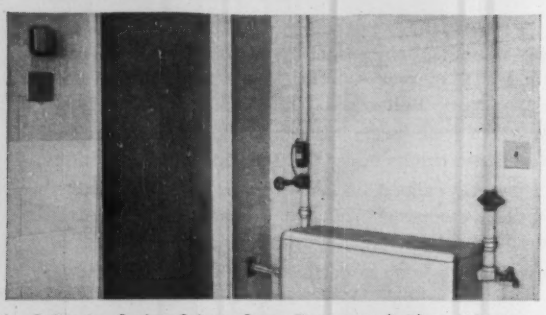
(Left): Swansea Elementary and High School, Swansea, South Carolina. *Architect:* Jesse W. Wessinger, AIA, West Columbia. *Engineer:* Marcus R. Durlach, Jr., Columbia. *Heating Contractor:* W. B. Guimarin Company, Columbia.



"Control Center" panelboard integrates components and accessories for heating system, serves as central junction point for wiring and adjustments. Three Proportioning Motor-Operated Valves at right are controlled by Adjustable Ratio Outdoor Reset Controls mounted at bottom of panelboard.



"Control Center" panelboard as it arrives on the job . . . prewired and prechecked, ready for swift, error-free connection.



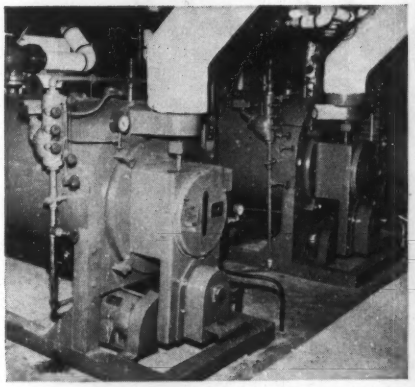
In Cafeteria, Barber-Colman Room Thermostat (left) and Strap-on Thermostat (center) control operation of cabinet-type heater.

Radiant floor panels, unit heaters, and finned pipe radiation are combined in the four-zone system to provide most effective heating of each area in the Swansea School. Temperature is lowered evenings and week ends by Seven-Day Time Clocks with manual override switches. Adjustable Ratio Outdoor Reset Controls position the Motor-Operated Valves, increasing or decreasing heat flow as dictated by outdoor temperatures. Every modern control feature is incorporated here, yet this simplified automatic electric system costs less to own, operate, and maintain than conventional systems. For complete information, phone your nearby Field Office, or write us.

BARBER-COLMAN COMPANY

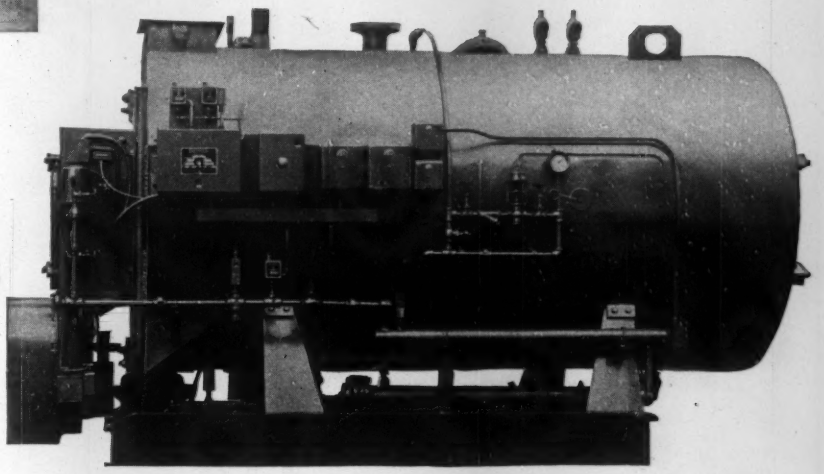
Dept. H, 1301 Rock Street, ROCKFORD, ILL., U.S.A. • Field offices in principal cities

Automatic Controls • Air Distribution Products • Industrial Instruments
Aircraft Controls • Small Motors • Overdoors and Operators • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery



LOW COST STEAM
with the
Continental "Packaged Boiler"

84.08% full load boiler efficiency... 99.77% dry steam reported by engineering firm



A consulting engineering firm conducted a test on a 150 hp Continental Automatic Boiler firing Bunker C Fuel Oil, under simulated field operating conditions in accordance with the A.S.M.E. boiler test code. The results give proof as to why Continental Boilers afford high steam quality and low fuel costs. As the test showed: steam quality was 99.77% dry . . . full load boiler efficiency was 84.08% . . . and stack temperature was considerably less than 100 degrees (F.) above steam temperature.

The consistently high efficiency and low stack temperature of the Continental Boiler are due mainly to ample heating surface, thorough mixing of atomized fuel and air, and the spinning gas technique.

Spinning Gas Technique

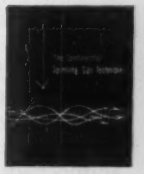
Continental's spinning gas technique retards the passage of hot gases through the furnace and return tubes – thus affording an exceptionally high rate of heat transfer . . . high boiler efficiency . . . and low stack temperature.

With the Continental, efficiency over 80% is *guaranteed* . . . and stack temperature is *guaranteed* not to exceed 125 degrees (F.) above saturated steam temperature at operating pressure.

Continental Automatic Packaged Boilers range from 20 to 500 hp; 15 to 200 lbs. W.P.

Write for new Bulletins BE3, BE4 and a copy of the boiler test report.

Bulletin BE3 . . . tells what to look for when you select a packaged boiler.



Bulletin BE4 . . . describes the Continental's Spinning Gas Technique.

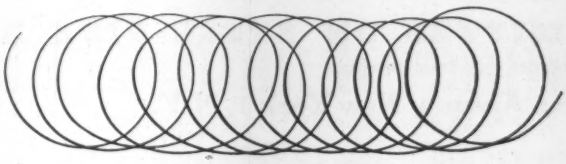
Continental Boiler Division

BOILER ENGINEERING & SUPPLY CO., Inc.

Phoenixville, Pennsylvania

40 years of boiler manufacturing experience

Continental is sold, installed and serviced by competent distributors throughout the U.S.



. . . the boiler with the Spinning Gas Technique

"Ah... here's snow melting!"

sign of a progressive business

People who buy are often unfairly referred to as the "fickle public." Nothing is further from the truth . . . for there is nowhere displayed greater constancy than by a really *satisfied* public.

Progressive, successful businesses are increasingly aware of their obligation to perpetuate this public loyalty by making it easy, convenient and comfortable for customers to do business. Hence *snow melting* has taken its place along with air conditioning, good lighting, adequate rest rooms, ample parking facilities and other conveniences that win public esteem.

For sidewalk, driveway, and parking area snow melting and ice removal systems, *steel pipe* is the overwhelming choice. For steel pipe is economical, formable and weldable for grid and coil fabrication, and has been proved in more than 60 years of conventional hot water and steam heating applications. In fact it is the most widely used pipe in the world for plumbing, heating, fire sprinkler systems, air, gas and water lines!

Ask for the new 32 page color booklet, "Steel Pipe Snow Melting and Ice Removal Systems." It is yours, free and without obligation.

Steel Pipe is First Choice

COMMITTEE ON STEEL PIPE RESEARCH

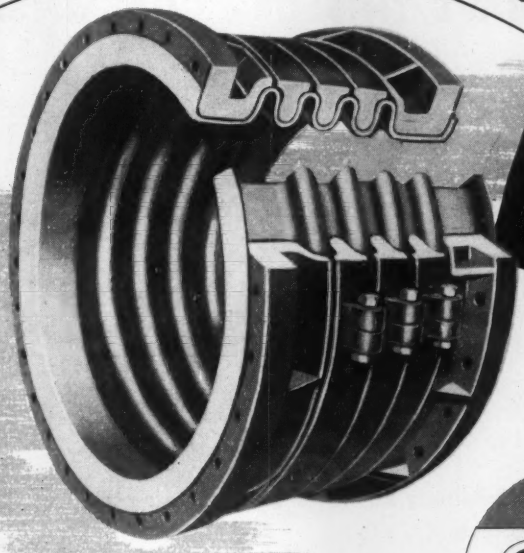
AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

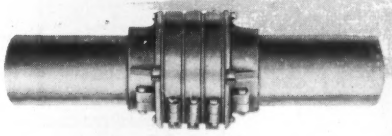
BADGER *Expansion Joints*

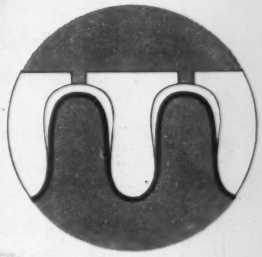
Typifying Joint Engineering at its Best

Controlled Movements

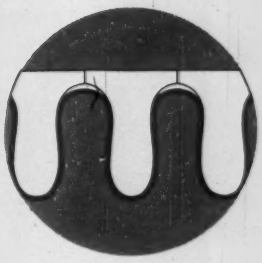


through **DIRECTED FLEXING**





STARTING POSITION
(LINE COLD)



FINAL POSITION
(FULL TEMPERATURE)

WITH THE OLD STYLE corrugations, there was little control over the flexing movement. Our engineers long ago found this to be a major cause of uncertain joint life and set about to solve the problem.

Directed Flexing, based on a scientifically engineered design of all-curve corrugation, solved the problem. That was some years ago. Notwithstanding continual further studies, nothing anywhere has supplanted Directed Flexing as a major design factor in long joint life. It's another example of what engineering has done to make the Badger Expansion Joint 'tops' in its field.

Badger Expansion Joints come in a variety of types and a wide range of sizes: Directed Flexing, Self-Equalizing for normal and long traverses and higher pressures; Non-Equalizing, for short traverse or when pressures are low; Tandem Joints for combination axial and lateral movements; Clevis-Hinged Joints for angular movements; Special Vibration Control Joints; Flexible Pipe Line Seals for watertight connection between pipes and flood walls.

BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET · CAMBRIDGE · MASS.

GET DOUBLE PROTECTION!

ONLY STAYNEW

AUTOMATIC AIR FILTERS HAVE THIS DRY CURTAIN.....

Staynew Model A-3 Automatic is the only air filter designed to give the *double protection* of double filter curtains—the first wet, the second dry. There's never oil entrainment and the cleaned side of curtains is always on the filtered air side. Staynew Model A-3 Filters are designed for both light dust load installations and for heavy duty industrial service where large volumes of air are to be filtered.

Automatic Self Cleaning Type Filter

- Highest efficiency of any mechanical type automatic filter.
- Exceptionally large dust holding capacity.
- Absolutely no oil entrainment in air stream.
- Motor and control unit mounted on clean side of filter.
- Combination gear and roller chain drive (no belts to slip).

Bring your filtration problems to Staynew. If the filtration of large volumes of dirty air at high efficiency and low cost is required, let the Dollinger engineers show you how and why Staynews are your answer. Write for descriptive folder.

Representatives in Principal Cities

DOLLINGER REG. PROTECTOMOTOR U.S. PAT. OFF. STAYNEW FILTERS

DOLLINGER CORPORATION

9 Centre Pk., Rochester 3, N. Y.

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Remember the trade marks "tt" and "TUBE-TURN" are applicable only to products of TUBE TURNS.

Engineered for tough service

TUBE-TURN CONCENTRIC REDUCERS provide a gentle transition from large to small diameters with strong knuckle contours. They exceed the pipe itself in bursting strength and have fatigue strength equal to that of the joining butt weld.

This extra quality at no extra cost is typical of the entire Tube Turns' line. You can specify TUBE-TURN Welding Fittings and Flanges and *know* that you will get the *exact* answer to your specific piping problem. This leading line includes more than 4000 items in all piping materials, schedules and sizes to match *your* design . . . available promptly through your nearby Tube Turns' Distributor.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS

LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Cleveland • Chicago • Denver • Los Angeles
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PIPING PROBLEM

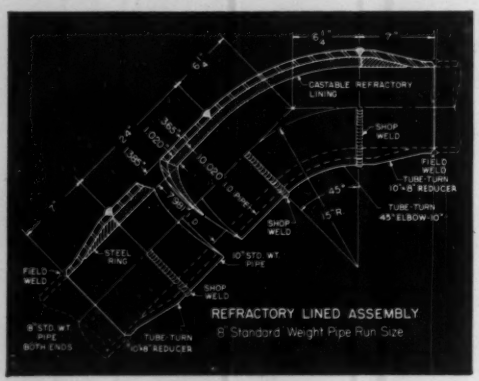
YOUR PIPING PROBLEM?

Here's service to help you...

TUBE TURNS' Engineering Service Division is staffed with men of wide experience to help solve your piping problems. Typical of many they encounter is this:

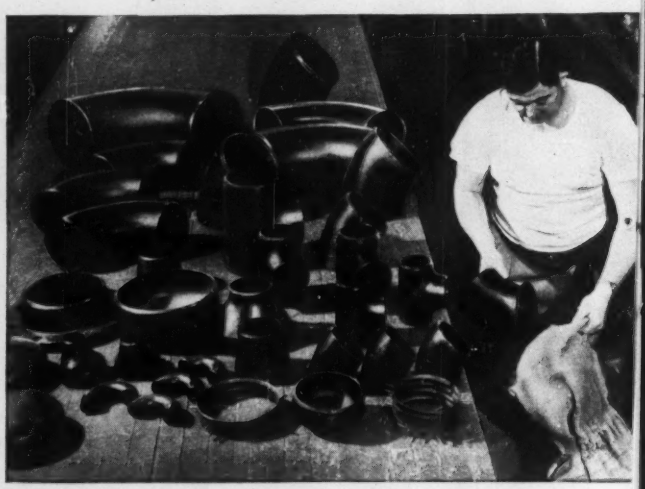
The general practice in handling highly abrasive materials in piping is to use heavy wall carbon steel elbows for directional changes, and replace these as they wear out. Recently, a new pipe lining . . . a zirconia-corundum refractory . . . was introduced with exceptional wear-resistant properties. This offers a highly satisfactory solution to the abrasion problem. The sketch shows how this lining can be applied to a 45° elbow by combining with two reducers.

This application is practical for piping of 4" through 12" diameter. Minimum thickness for casting of refractory is about one inch. It should be confined to mild pressure-temperature conditions. Additional details are available from Tube Turns' Engineering Service Division.



Design of 45° directional change with refractory-lined elbow.

YOUR SIZE: These ½-inch and 42-inch TUBE-TURN Welding Elbows are the extremes in the range of diameters available out of stock in carbon steel. Tube Turns' complete line of more than 4000 items includes fittings and flanges in carbon steels, stainless steels, chrome-moly steels, copper, aluminum, brass, monel metal, nickel and wrought iron.



YOUR SOURCE: The nearby Tube Turns' Distributor provides prompt delivery of TUBE-TURN Welding Fittings and Flanges to meet your needs exactly. He acts as your warehouse. He cuts your purchasing red-tape and time. He is backed up by the entire Tube Turns' organization.

YOUR DATA... Tube Turns has compiled data on many phases of piping application. For Example: This booklet on "the why and where" of stainless steel piping is yours for the asking. Just mail the coupon.

TUBE TURNS, Dept. A-4
224 East Broadway, Louisville 1, Kentucky

Please send free copy of booklet on Stainless Steel Piping.

Company Name _____

Company Address _____

City _____ *Zone* ____ *State* _____

Your Name _____

Position _____

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Philadelphia	Seattle
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Chicago	Tulsa
Denver	Houston
Los Angeles	Dallas
Midland, Texas	

"TUBE-TURN" Reg. U.S. Pat. Off.

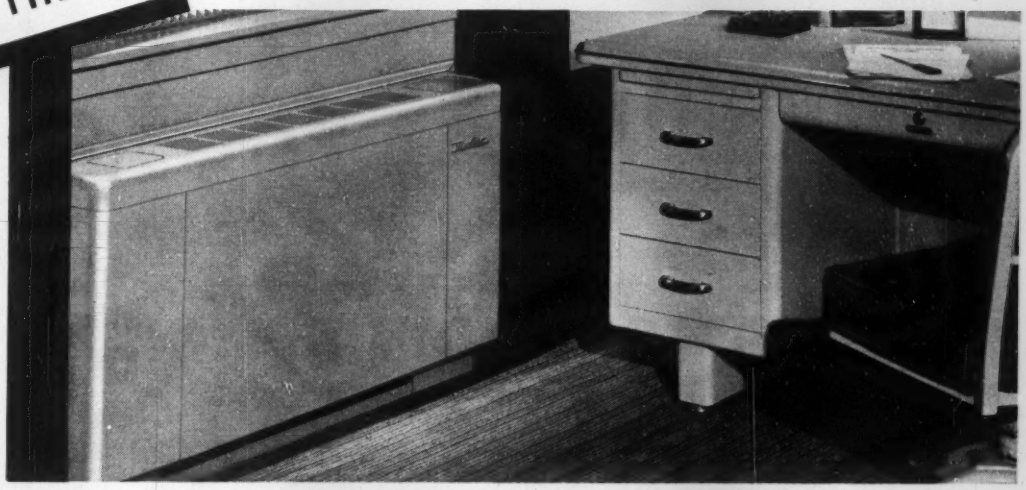
TUBE TURNS

A DIVISION OF NATIONAL CYLINDER GAS COMPANY
LOUISVILLE 1, KENTUCKY

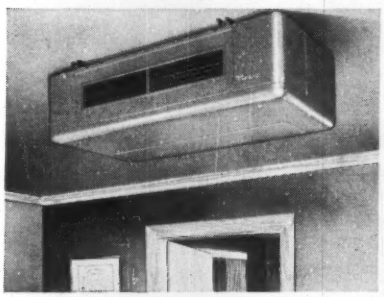
NOW — for low-cost, year 'round air conditioning of individual rooms

YOUR CHOICE OF 4 TYPES OF THE NEW

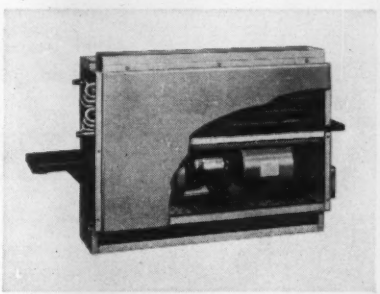
Modine Airditioner



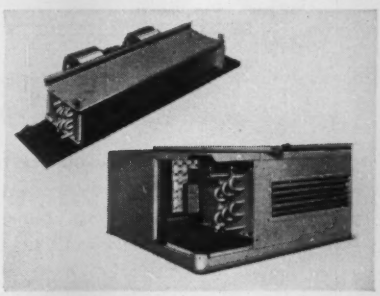
CONSOLE MODEL—superbly styled and finished—blends gracefully with any interior decor. Design facilitates recessing—only 6 in. need project into room. Also for free-standing installation.



CEILING MODEL — deluxe unit for exposed installation on ceiling—saves floor space.



CONCEALED MODEL (front panel cutaway) permits out-of-sight installation in wall.



OVERHEAD MODELS—with or without plenum and filter for use in furred space.

HERE'S low-cost cooling, heating, ventilating, filtering, dehumidifying and circulating of air for individual rooms. Ideal for hotels, offices, apartments, motels, hospitals and similar multi-room applications. AIRditioners* save cost of installing central duct systems in new buildings. On modernization jobs, they solve the difficult problem of providing supply and return ducts in existing walls.

Cold water from a central chiller or other source is piped to each unit for summer cooling. Heating is accomplished with hot water from a central heating plant. *The same piping* —water supply and return, and drain —serves each unit for both cooling and heating. And AIRditioners are *individually controllable.*

Get all the facts on the new AIRditioner from the Modine representative listed in your classified phone book. Or clip this coupon and mail it today.

*Trademark

Modine Airditioner

MODINE MFG. CO.
1509 DeKoven Ave.
Racine, Wis.

Please send me a free copy of Bulletin describing "The New Modine AIRditioner."

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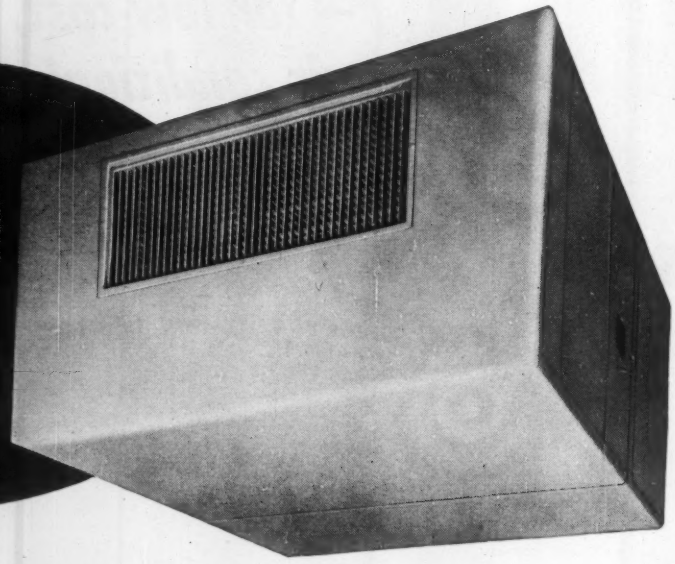
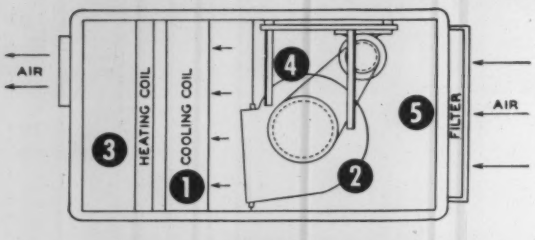
NEW FEATURES of PROVEN MERIT



KRAMER

AIR CONDITIONING UNITS



1 MUGGY-AIR-CONTROL

It "squeezes" extra moisture from the air on muggy days without reheating, dampers or excessive cooling. No short cycling and uncomfortable conditions.

2 "BLOW-THROUGH" DESIGN

Fan-motor assembly always exposed to normal room temperatures. A unique design with many advantages, resulting in —

No motor overload and no loss of bearing lubricant from hot air of the heating coils.

No corrosion of fan-scroll assembly from moisture carry-over of the cooling coils.

3 ANTI-SWEAT CONSTRUCTION

Only a small portion of the casing is exposed to cooled air; that section is heavily insulated.

Access doors and grille have scientific anti-sweat designs.

4 QUIET OPERATION

The fans and motor form an integrated assembly independently rubber-mounted to the casing. All moving parts are completely isolated by rubber.

5 FOR FINISHED INTERIORS

Graceful lines with no unsightly belts, motor and guards exposed to view. Finished in hammer gray enamel.

MANY OTHER OUTSTANDING FEATURES.

WRITE FOR BULLETIN AC-238

KRAMER TRENTON CO. • Trenton 5, N.J.

choose the valve that fits the job

instead of making the job fit the valve

ALCO T SERIES THERMO VALVES

Two types to cover every application:

STRAIGHT-THROUGH CONNECTIONS
ANGLE CONNECTIONS

inside they're identical — parts are interchangeable easy to service

For all temperature ranges — all operating conditions. Please specify type desired when you order.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

ASK YOUR ALCO WHOLESALER FOR BULLETIN 171-53

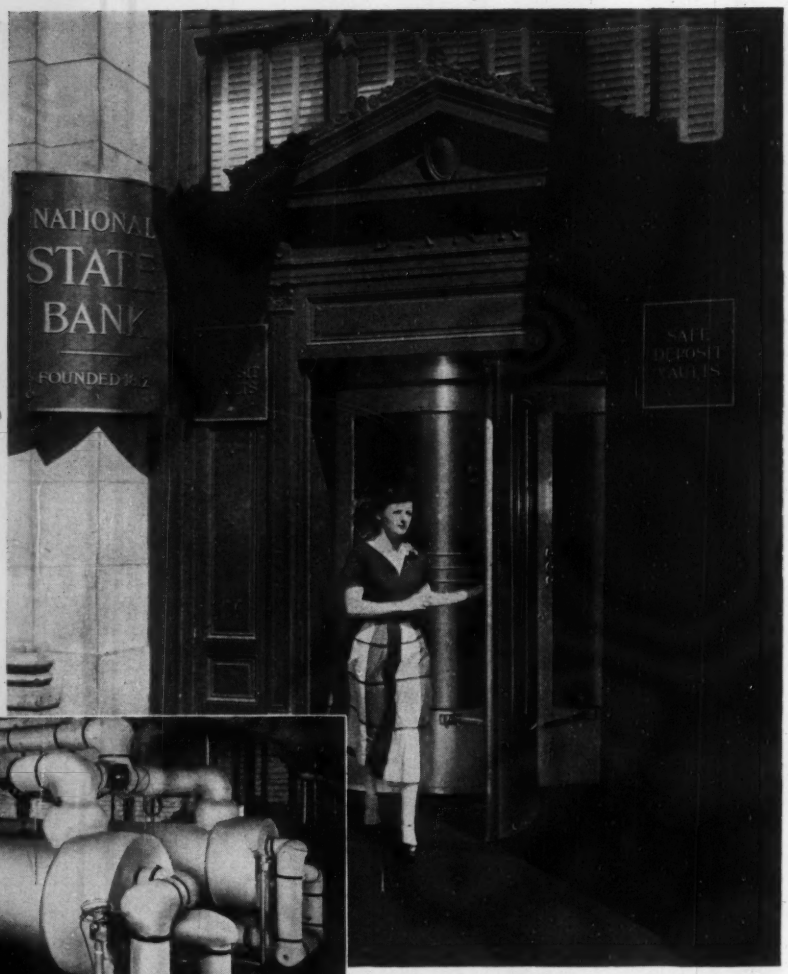
ALCO

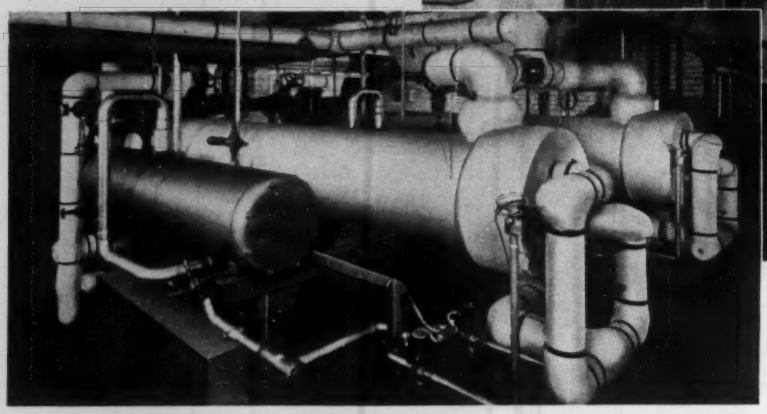
ALCO VALVE CO.

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

p-k Freon Coolers

HOLD POSITIONS OF TRUST AT 12½%





National State Bank Building in Newark, New Jersey. **p-k** Freon 22 Coolers were specified by Delta Engineering and Conditioning Co., Inc., East Orange, New Jersey. "We specify them because they are the best" says William Adelman of Delta.

The air conditioning system of the National State Bank Building, Newark, New Jersey, is regarded as a sound, long-term investment in business efficiency. Initially installed to air condition ten floors of which three are now in operation, the other seven floors may be added at the bank's option *without* changes or additions to the basic refrigeration cycle.

p-k Freon Coolers are an integral part of this system. Two of these coolers provide a total capacity of 125 tons of refrigeration cooling water at the rate of 300 gpm from 52°F to 42°F. Even at 12½% total capacity, proper gas velocities are maintained for efficient operation.

Men who specify **p-k** coolers once are very likely to specify them again. **p-k** coolers were chosen for the National State Bank on the basis of previous experience. Efficient and economical, they now occupy positions of trust in countless commercial and industrial buildings.

p-k is a pioneer in the development of many types of heat exchange equipment. Whatever your heat exchange needs—heating or cooling—talk to **p-k** about them.

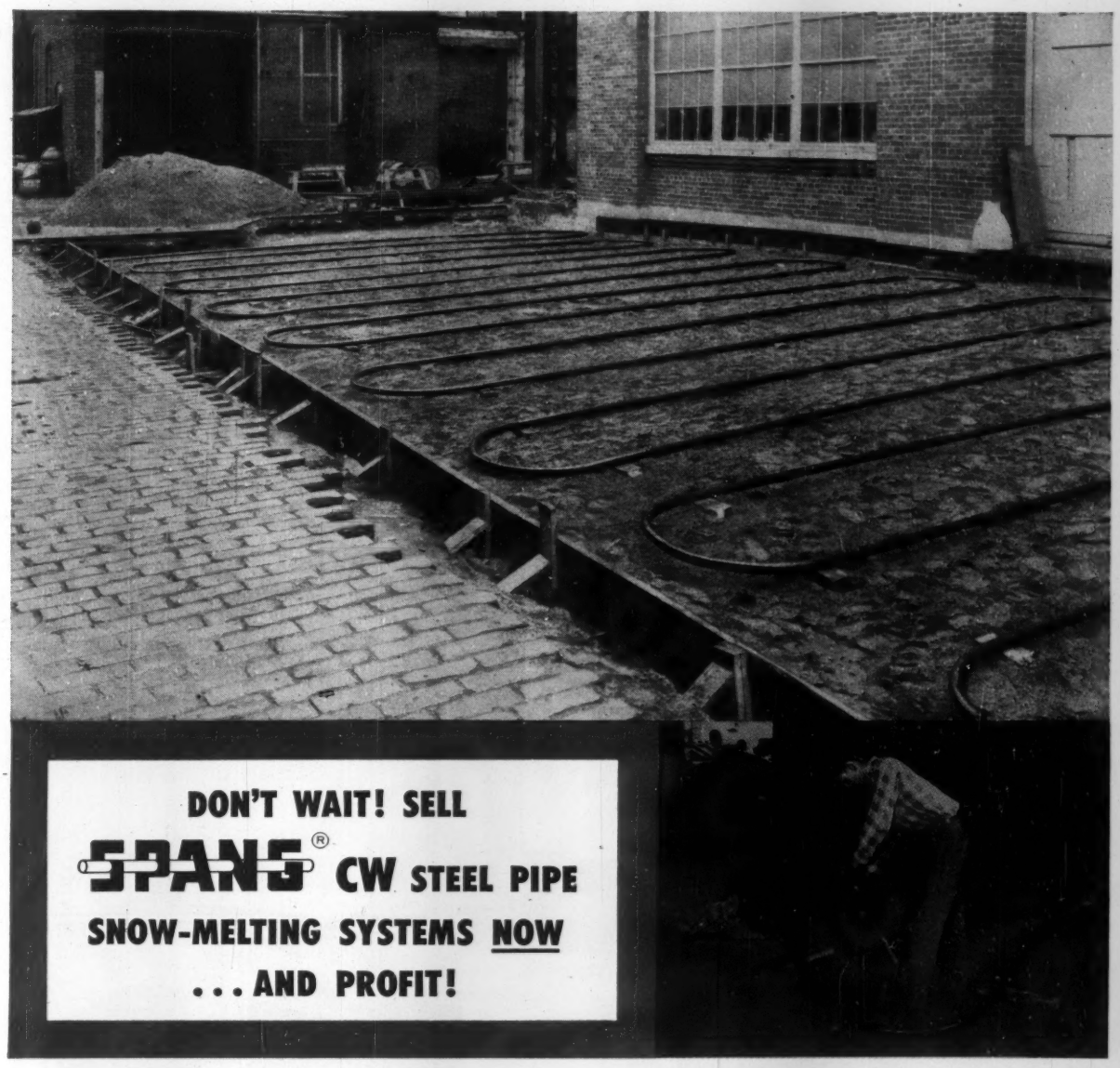
Write for literature or engineering help. No obligation, of course.

the Patterson-Kelley Co., inc.

780 Burson Street, East Stroudsburg, Penn.

2502

101 Park Avenue, New York 17 • Railway Exchange Building, Chicago 4 • 1700 Walnut Street, Philadelphia 3 • 96-A Huntington Avenue, Boston 16 • and other principal cities.



DON'T WAIT! SELL

SPANG® CW STEEL PIPE

SNOW-MELTING SYSTEMS NOW

. . . AND PROFIT!

Now is the time to talk to your customers about snow-melting systems. A SPANG CW Steel Pipe snow melting installation is the perfect answer to that annual winter problem of removing snow and ice. It keeps driveways, garage entrances, sidewalks and loading platforms open all year around. And it offers these user benefits:

- high cost of manual or mechanical snow removal eliminated forever
- provides increased convenience for customers and tenants . . . builds goodwill
- permits more dependable shipping and delivery schedules
- prevents damage to paving from salt or chemicals
- ends accident claims resulting from falls on slippery walks
- eliminates danger of injury through straining or over-exertion from shoveling

And a SPANG CW Steel Pipe Snow Melting System has additional dividends for you. That's because SPANG CW is quality-controlled during its manufacture . . . which makes it easier to cut, bend, thread and weld. It's thoroughly tested and inspected before shipping . . . which assures you of *top-quality* pipe with years of trouble-free service life.

Now—while the weather is warm—is the time to sell snow-melting systems. Make SPANG CW Steel Pipe *your* choice of material for the best results. See your local SPANG Distributor for all your piping needs.

SPANG-CHALFANT

DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Two Gateway Center, Pittsburgh, Pennsylvania. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

DETROIT ROTOSTOKERS

Are To Be Used To Efficiently

Fire The Boilers In

The New Prudential Mid-America

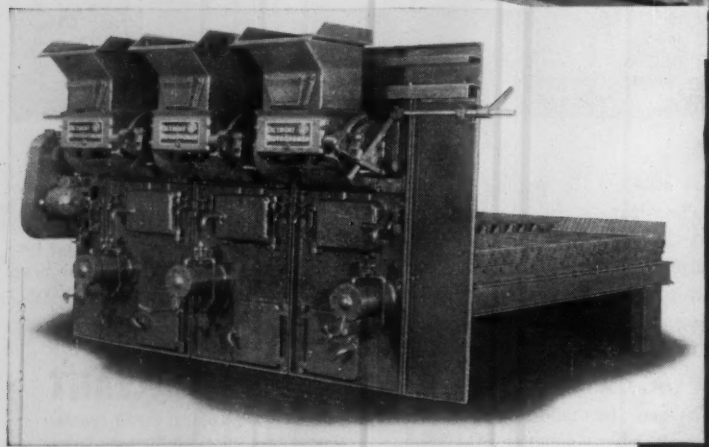
Home Office Building—Chicago

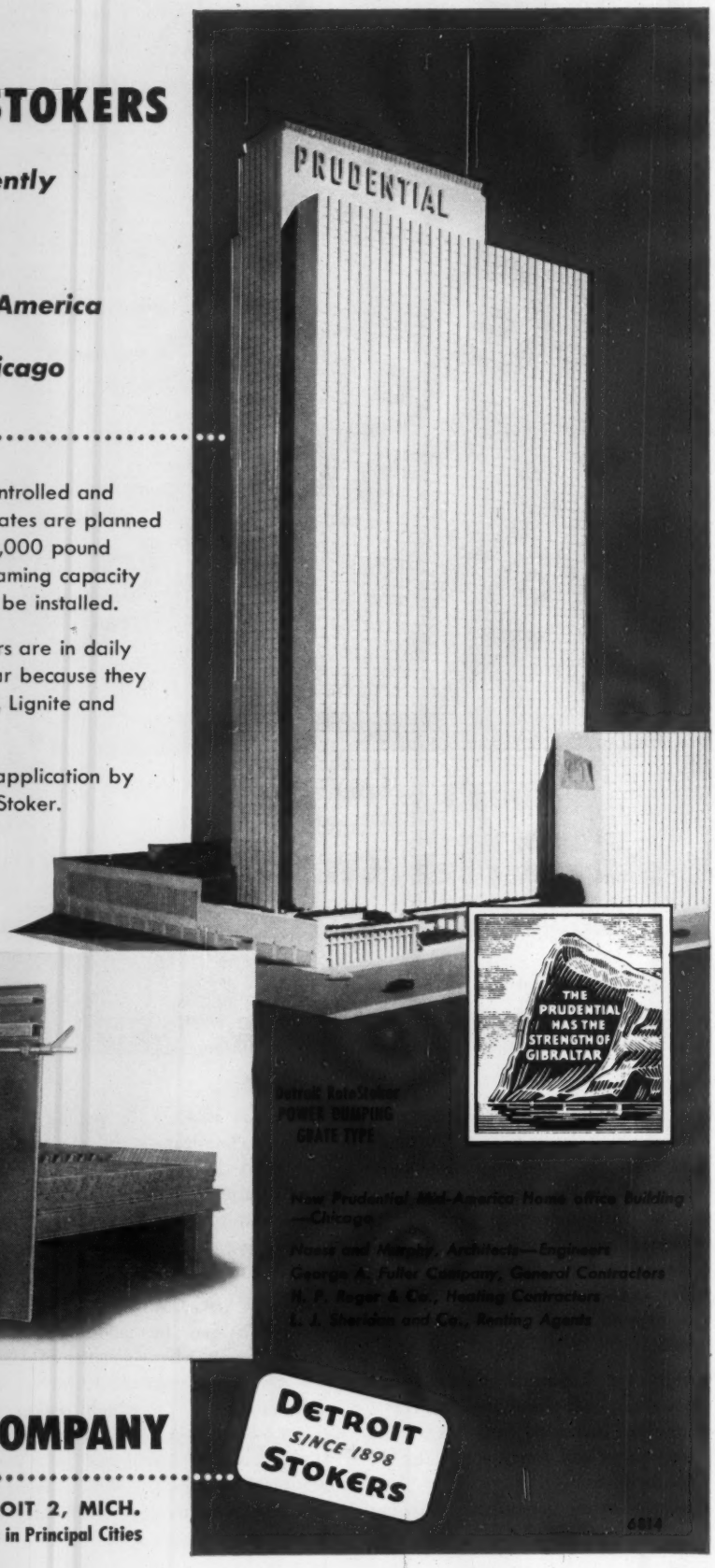
Detroit RotoStokers, automatically controlled and having Power Operated dumping grates are planned to burn southern Illinois coal. Two 40,000 pound and one 22,000 pound per hour steaming capacity Erie City Steam generating units will be installed.

Many hundreds of Detroit RotoStokers are in daily operation in prominent plants. Popular because they successfully burn all Bituminous Coals, Lignite and also wood and other refuse fuels.

Buy a stoker for proper design and application by experienced builders. Buy a Detroit Stoker.

Write for a catalog. No obligation.





Detroit RotoStoker POWER DUMPING GRATE TYPE

New Prudential Mid-America Home office Building —Chicago

Naess and Murphy, Architects—Engineers
George A. Fuller Company, General Contractors
H. P. Roger & Co., Heating Contractors
L. J. Sheridan and Co., Renting Agents

6814

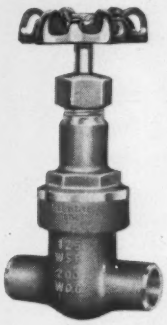
DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.
Works at Monroe, Mich. • District Offices in Principal Cities

DETROIT SINCE 1898 STOKERS

FOR COPPER-TO-COPPER
Use these Fast Heating-Easy Soldering
O-B VALVES

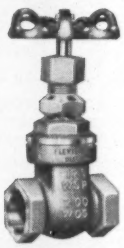
No. 2800 GATE
Non-Rising Stem
125 lbs. WSP — 200 lbs WOG
Flexitite Disc®



No. 2900 GATE
Rising Stem
125 lbs. WSP — 200 lbs. WOG
Flexitite Disc

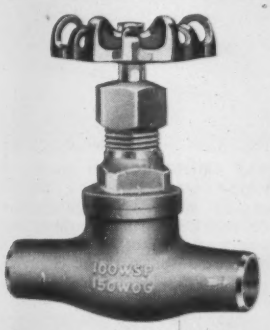
No. 1601 GLOBE
125 lbs. WSP — 200 lbs. WOG
Composition Disc. Also available in Angle, Swing Check.

With Braze-Type Ends for Type-B Tubing



No. 6500 GATE
Non-Rising Stem
125 lbs. WSP — 200 lbs. WOG
Flexitite Disc. Also available in Swing Check.

No. 2400 GATE
Non-Rising Stem
100 lbs. WSP — 150 lbs WOG
Flexitite Disc. Also available with Drain.



No. 601 GLOBE
100 lbs. WSP — 150 lbs. WOG
Composition Disc
Also available in Angle, or with Drain.

Ohio Brass Valves

BRONZE GLOBES, ANGLES, GATES AND CHECKS FOR INDUSTRIAL AND DOMESTIC SERVICE

FOR COMPLETE INFORMATION ON SIZES, LIST PRICES WRITE FOR BULLETIN NO. 1314-V

Ohio Brass Company
Mansfield, Ohio

Please send me the bulletin, 1314-V, on O-B Solder-Type Valves

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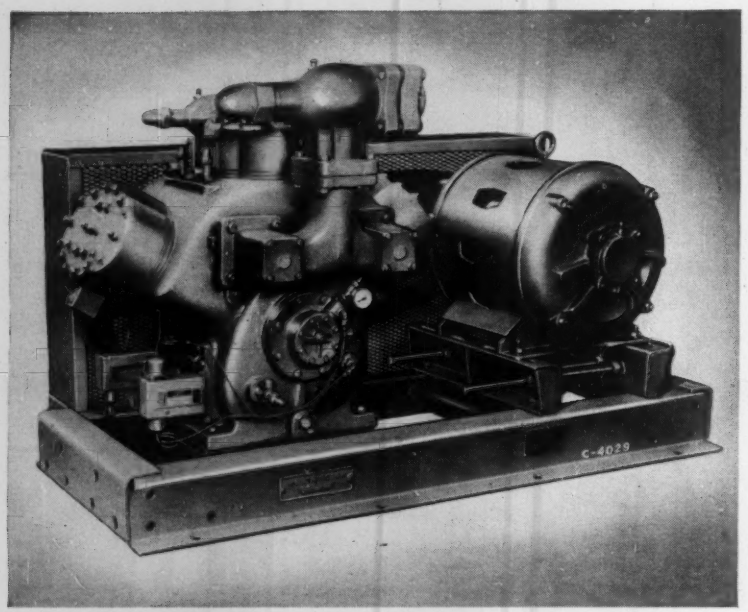
STREET .....

CITY ..... STATE .....

4463-V

The whole industry's talking about Worthington's new Freon compressor



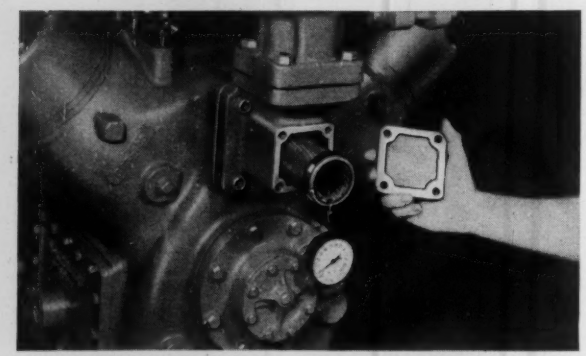
TRIM, STURDY CONSTRUCTION marks this 4JF6 compressor unit — 50-60 hp, six cylinder W-type compressor. The complete compact unit consists of fabricated steel base, compressor with valves, gauges and safety controls, drive and safety guard. Designed to operate in conjunction with Worthington evaporative condensers in localities where city water is scarce or high in cost. Also available with shell and tube condenser. Complete range from 3-150 hp.

"The high capacity unit we've been waiting for!"

"Greater operating efficiency!"

"There's nothing else like it!"

And every comment you hear is true! The refrigeration compressor is the most vital element of any air conditioning or refrigeration system. That's why Worthington spent years in developing the new "J" Freon compressor. That's why Worthington invested over a million dollars in compressor research. *And that's why you can't find its match in any other unit.* Only a few features of the new "J" Freon compressor are highlighted here — get the full story by contacting your nearest Worthington district office or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Section A.4.33, Harrison, New Jersey.



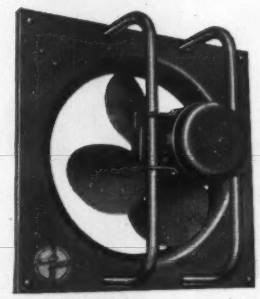
EASY REMOVAL of suction gas strainer for cleaning is made possible by new suction manifold design. No pipes, valves or other parts need to be dismantled in order to get at the strainer. And Worthington's new electric unloaders automatically balance power consumption with load requirements.

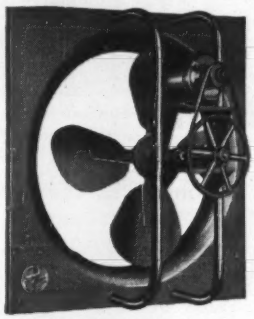
LORD & TAYLOR'S new West Hartford, Conn., store depends on Worthington to provide comfortable air conditioning for its customers. Two 150 hp "J" compressors and two evaporative condensers make up the highly efficient Worthington air conditioning team at this modern store.

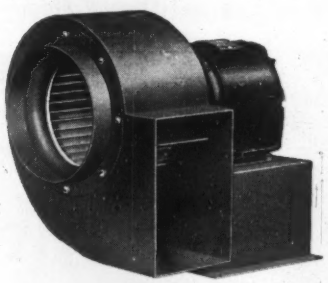
A.4.33

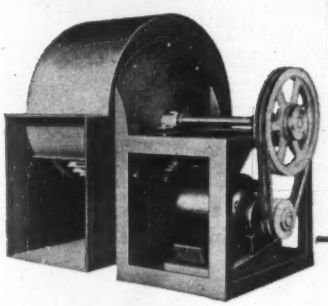
WORTHINGTON

CLIMATE ENGINEERS TO INDUSTRY, BUSINESS AND THE HOME









IMMEDIATE DELIVERY

COMPETITIVE PRICES

ON-THE-JOB ENGINEERING

If competition's getting tough, you need the kind of service and products that Peerless—and **ONLY PEERLESS**—offers. You want fast deliveries—OK, you get them immediately on any fan or blower in the big Peerless line. You want prices—OK, you get them from Peerless because Peerless builds the entire unit, determines its own prices, pegs prices and holds them. You want engineering help—OK, you get it at no cost from Peerless simply by asking for it, and if necessary, Peerless flies an engineer to your office. You want to eliminate call backs—OK, you do it with Peerless because you get rugged construction, sound engineering and guaranteed motors that are built and job-matched by Peerless for the specific fans and blowers they power.

Peerless gives you everything you need: iron-clad guarantees—and product registrations that permit you to order replacement parts by number.

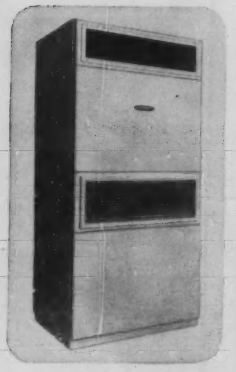
Check and see, compare and prove that you buy best, sell best, install best and are served best when you deal with the fan and blower manufacturer that offers you most—Peerless Electric.

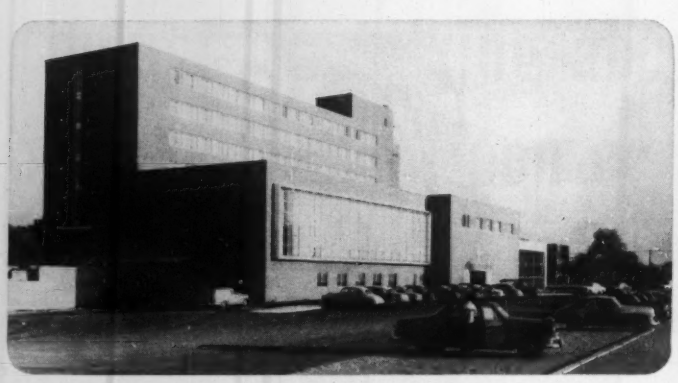
FAN AND BLOWER DIVISION

THE PEERLESS ELECTRIC COMPANY

1409 West Market St., Warren, Ohio

Peerless Electric





Fountain in the garden of the Student Union.

New Student Union Selects Air Conditioning & Refrigeration

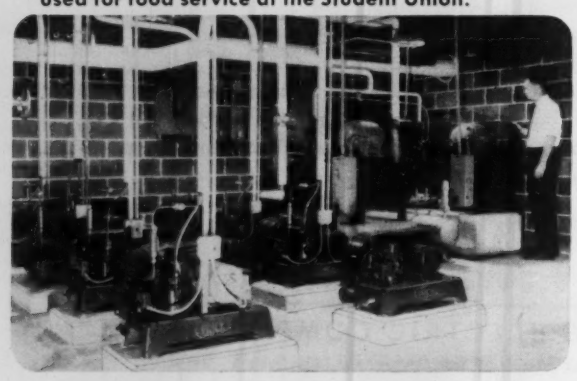
This fine building of the Indiana University Medical Center, at Indianapolis, comprises apartments, guest rooms, dining halls, shops, swimming pools, etc.

Here both air conditioning and food service loads are handled by 13 Frick refrigerating machines, and a Frick unit air conditioner. Seven fractional-horsepower units serve food-dispensing equipment, while four of 7½ horsepower each cool a dozen walk-in boxes. The Frick "ECLIPSE" machines operate a chilled-water air conditioning system. Installation by Hayes Bros., Inc., Distributors at Indianapolis and South Bend.

For that important cooling job of yours, specify Frick equipment: there's nothing to compare with it. Write now for Bulletin 100 on "ECLIPSE" compressors.

The book store, cafeteria, and other public spaces are all air conditioned.

Below: Some of the 11 Frick low-pressure units used for food service at the Student Union.

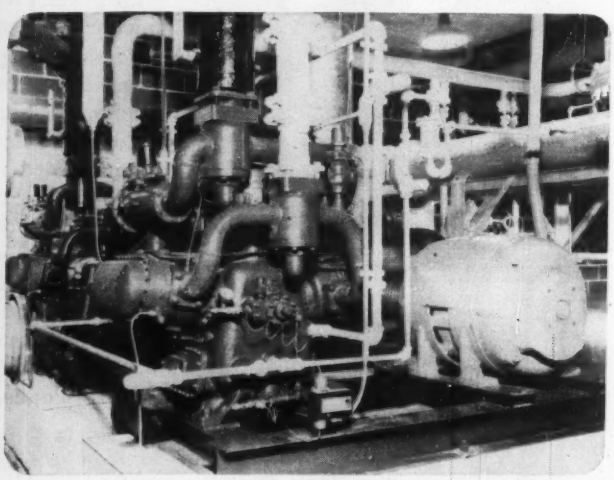


DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery



Two Frick "ECLIPSE" compressors, each with nine cylinders, handle the air conditioning of public spaces in the Student Union at Indianapolis.

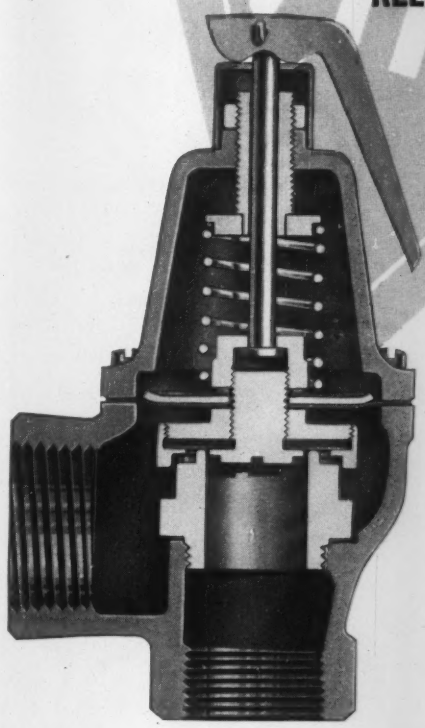
The first disc-to-metal seated A.S.M.E. steam rated

"Non-Metallic"

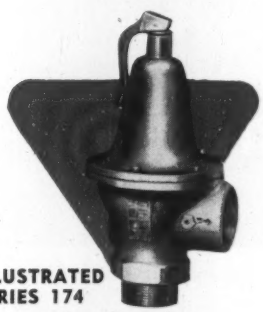
HOT WATER PRESSURE SAFETY RELIEF VALVE

Complete PRESSURE PROTECTION

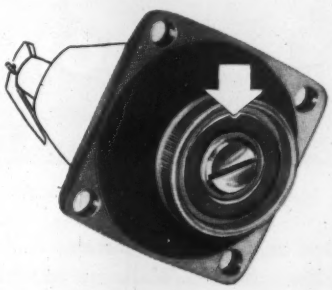
These steam rated water pressure safety relief valves provide ***complete pressure protection*** regardless of high temperature (pressure boiling point) conditions. To appreciate the value of what ***complete pressure protection*** means, in the event of emergency run-away firing conditions, these valves will discharge excessive water pressure created by thermal expansion and also excessive steam pressure. The nonmetallic disc-to-metal seating for water service, originated in Watts valves, is now regarded by leading authorities as the best for tight seating.



The Original
WATTS 3/4" No. 74



ILLUSTRATED SERIES 174
Watts makes the only complete line in sizes 3/4" to 2".



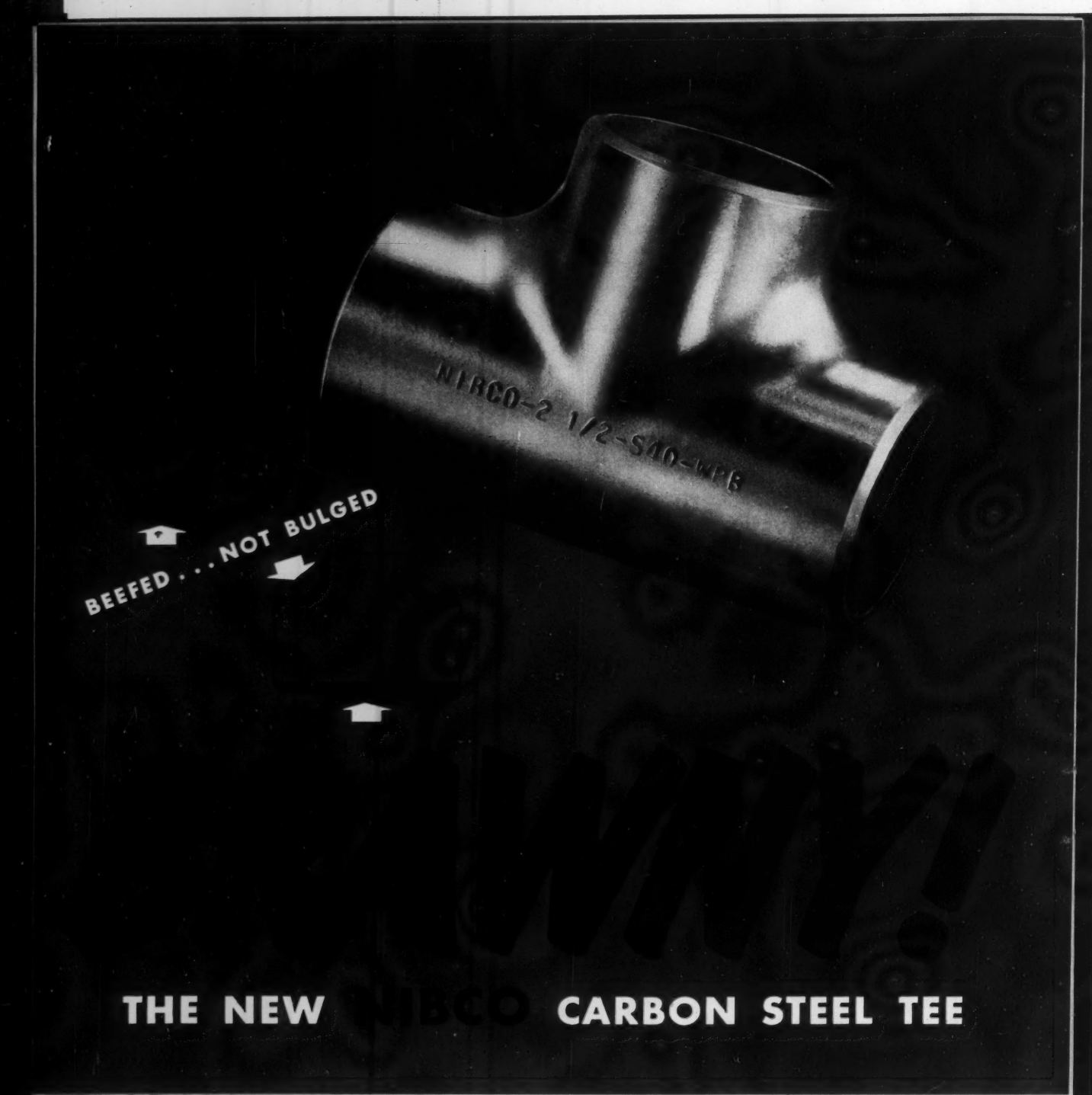
- **Several years ago** Watts material research department found that Silicone Rubber had ideal characteristics for the disk requirements of our No. 74 and 174 series.
- POSITIVE SEATING.
- EXTREMELY LOW WATER ABSORPTION.
- ABILITY TO WITHSTAND HEAT UP TO 400°F.
- NON-VULCANIZING.
- LOW COMPRESSION SET EVEN AT HIGH HEAT.

Since 1874

THE WATTS REGULATOR COMPANY

LAWRENCE, MASSACHUSETTS

Manufacturers of Plumbing and Heating • Safety Valves and Controls



THE NEW NIBCO CARBON STEEL TEE

All NIBCO Welding Tees meet A.S.A. Specification B16.9-1940

U.S. PATENTS 2,027,285—2,111,695—2,557,403

NIBCO

Controlled cold-flow of metal makes the NIBCO Tee the strongest point in the pipe line. Walls are reinforced with extra metal thickness where extra strength is needed. NIBCO's exclusive forming operation creates a denser grain structure that makes the tee stronger and more resistant to corrosion. Look for the distinctive "Brawny" shape, the smooth unrestricted passages and the beautiful cold-formed finish. They're your clues to superior performance in NIBCO "Brawny" Carbon Steel Welding Tees. You can get them through your regular source of supply.

NORTHERN INDIANA BRASS COMPANY, 871 Plum St., Elkhart, Indiana

NOW! PERFECT WEATHER

. . . at your finger tips!

when you plan with . . .

HERMAN NELSON
HEATING AND VENTILATING UNITS

Custom-Assembled from standard components

Wide choice of Fan Sections
Many Radiator Types and Capacities
Humidifier — if desired
Choice of Filter Sections
Mixing Damper Section if desired

NEW!

Write for Catalog No. 775

Custom-assembled from standard components, Herman Nelson Heating and Ventilating Units give you all the flexibility of specially designed systems at prices no higher than ordinary "fixed" units with similar capacities. Choose from seven different radiators – three distinct filter types – a wide range of motor sizes and fan combinations; further choices, too, in unit bases, wall intakes, damper sections, humidity control.

Let us show you how a Herman Nelson Heating and Ventilating Unit can fit into your specifications, do the job you want done, and do it with the greatest economy.

AAF herman nelson

American Air Filter COMPANY, INC. | **373 Central Avenue Louisville 8, Kentucky**

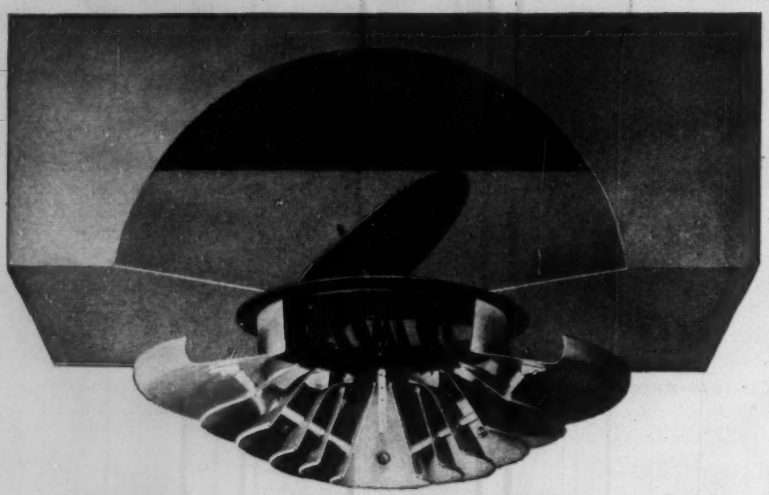
Here's a <u>new</u> way to cut costs and save time on

duct take-off installations!

ANEMOSTAT®

COMBO-UNIT COMBINES

{ VOLUME CONTROL
ANGLE RING
EQUALIZING DEFLECTOR

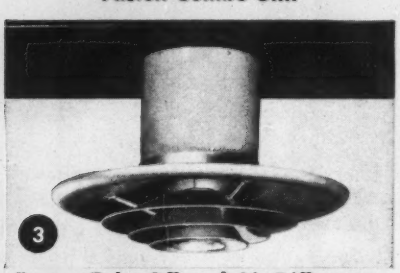


Anemostat's NEW Combo-Unit is a combination volume control, angle ring and equalizing deflector. ***This prepackaged unit cuts installation costs in half.*** Extra rings, screws and odd parts are not required. Installation time is reduced to a minimum, and it's a cinch to install. • Use Anemostat Combo-Units on your next job.

Easy, Quick Installation

Cut Hole in Duct

Fasten Combo-Unit



Fasten Take-Off and Air Diffuser or

Fasten Air Diffuser to the Combo

ANEMOSTAT®

DRAFTLESS *Aspirating* AIR DIFFUSERS

ANEMOSTAT CORPORATION OF AMERICA

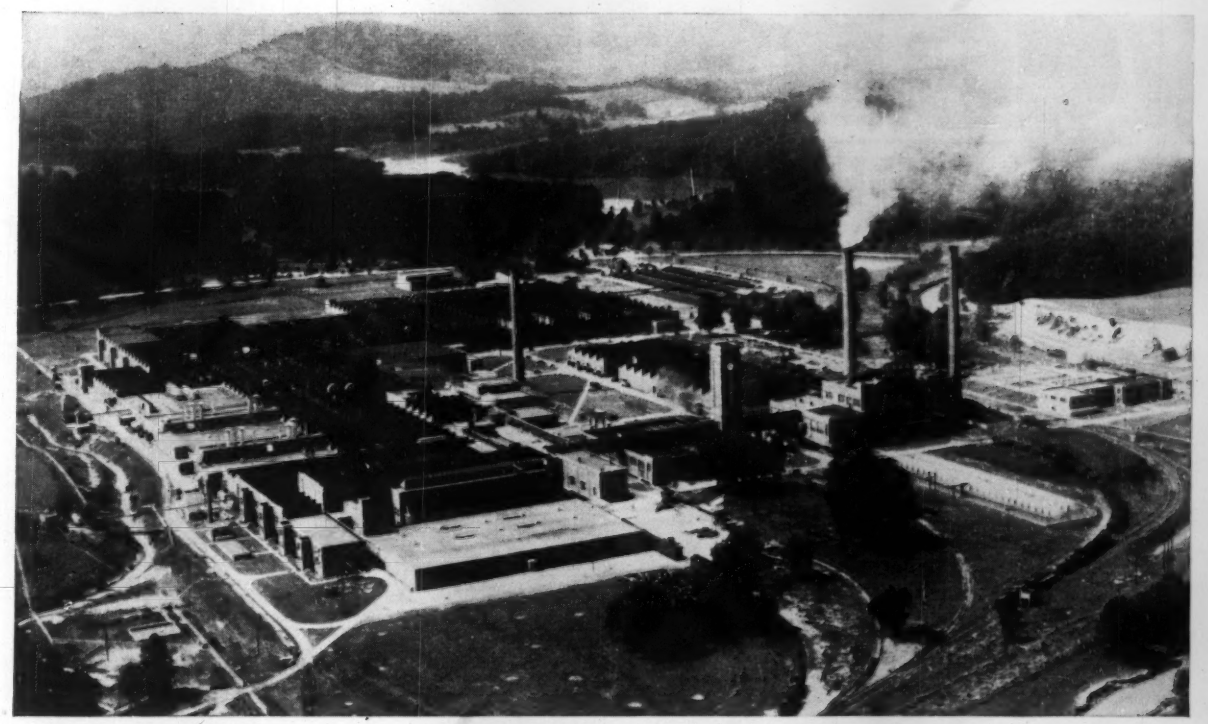
10 EAST 39th STREET, NEW YORK 16, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

AC 1310

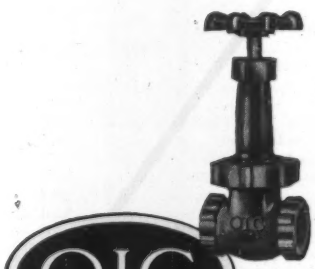
"No Air Conditioning System Is Better Than Its Air Distribution"

Oh, I see



. . . they're using our valves at

AMERICAN ENKA Rayon and Nylon Mills



Each valve in the complete line of modern OIC Valves is designed and built to fit a particular type of job. OIC Valves provide positive, leakproof control of flow. The result is longer service . . . less maintenance . . . true valving economy.

That's why OIC has gained acceptance at the American Enka Corporation, Enka, North Carolina, and at other important textile plants throughout the industry.

Talk with an OIC representative or an authorized OIC Distributor about your valve needs. You'll have a better idea of how to overcome specific valving complaints and problems, and at a saving.

Write for the OIC Catalog Digest for quick valve selection.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

OIC
FOUNDED 1883

VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES**

Now...Readily Available
General Chemical's
genetron® 141
GREEN LABEL

Quality Specifications

The extremely high quality standards to which General Chemical manufactures "Genetron" 141 are shown below. The purity of every pound is guaranteed to meet or even better these stringent specifications.

Moisture-wt. %, max.	0.0010
Chlorides	None
High boiling impurities-vol. %, max.	0.05
Non-condensable gases (gases insoluble in perchloroethylene)-vol. % in vapor phase, max.	5.0
Boiling pt. at 760 mm. Hg, °F.	−41.4
Boiling range °F. (to 85% pt.), max.	0.9

Selected Physical Data

Chemical Formula	$CHClF_2$
Molecular Weight	86.5
Boiling Pt. (°F) at 1 Atmosphere Pressure	−41.4
Evaporator Pressure at 5°F (p.s.i. absolute)	43.02
Condensing Pressure at 86°F (p.s.i. absolute)	174.5
Freezing Point (°F) at 1 Atmosphere Pressure	−256.0
Critical Temperature (°F)	204.8
Critical Pressure (p.s.i. absolute)	716
*Compressor Discharge Temperature (°F)	131
Compression Ratio (86°F/5°F)	4.06
Specific Volume of Vapor at 5°F (cu.ft./lb.)	1.246
Latent Heat of Vaporization at 5°F (B.t.u./lb.)	93.5
Net Refrigeration Effect of Liquid 86°F/5°F (B.t.u./lb.)	69.3
Specific Heat of Liquid at 86°F (B.t.u./lb.°F)	0.335
Specific Heat of Vapor at Constant Pressure of 1 atm. and 86°F (B.t.u./lb.°F)	0.15
Specific Heat Ratio at 86°F at 1 atm. (k=Cp/Cv)	1.18
*Coefficient of Performance	4.65
*Horsepower/Ton Refrigeration	1.016
*Refrigerant Circulated/Ton Refrig. (lbs./min.)	2.89
*Liquid Circulated/Ton Refrig. (cu.in./min.)	68.1
*Compressor Displacement/Ton Refrig. (c.f.m.)	3.60
Toxicity (Underwriters' Laboratories Group No.)	5A
Flammability & Explosivity	None
Odor	Ethereal
Solubility of Water in Liquid Refrigerant at 32°F (gm./100 gm. Refrigerant)	0.060
Solubility of Water in Liquid Refrigerant at 86°F (gm./100 gm. Refrigerant)	0.15
Oil Solubility (Miscibility with Lubricating Oils)	yes

*Based on 5°F Evaporator Temperature and 86°F Condenser Temperature

Principal Uses

In reciprocating compressors for—

- "Package type" air conditioning units
- Home freezers
- Low-temperature industrial process work

the "super-dry"

MONOCHLORODIFLUOROMETHANE

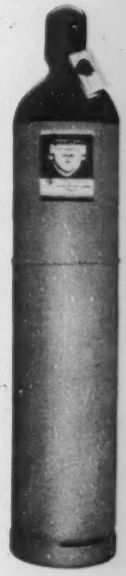
Reduce Corrosion Problems – Costly Breakdowns

The industry asked for it. Now, in "Genetron" 141, General Chemical provides refrigeration manufacturers, wholesalers and servicemen with really "dry" monochlorodifluoromethane. "Genetron" 141 has a guaranteed moisture content of not more than 10 parts per million . . . and it is so carefully made that it consistently runs well below!

Yes, as a result of General Chemical's manufacturing methods, "Genetron" 141 is truly "super-dry." With it, any user, anywhere, can be sure of getting this important refrigerant the way the industry wants it . . ."bone dry."

Comparison will quickly prove the merits of "Genetron" 141. That's because "Genetron" 141 was especially developed to give you all the benefits of monochlorodifluoromethane without the problems that have been encountered with higher moisture material. And—equally important—you get all the high quality and superiority of "Genetron" 141 without spending a red cent extra!

For further information on "Genetron" 141, write or wire the nearest General Chemical office listed below. Remember—in refrigerants—the name "Genetron" stands for superior, "super-dry" products—made for today and tomorrow!



Color Coded for your Convenience

To distinguish its "super-dry" product, General Chemical has given it the special numerical designation—141.

For your convenience—to speed identification and prevent mistakes in use—container heads and labels are color-coded with the familiar pale green that indicates monochlorodifluoromethane everywhere in the industry.

Allied Chemical

GENERAL CHEMICAL DIVISION

ALLIED CHEMICAL & DYE CORPORATION

40 Rector Street, New York 6, N. Y.

Offices: Albany • Atlanta • Baltimore • Birmingham • Boston • Bridgeport • Buffalo • Charlotte • Chicago Cleveland • Denver • Detroit • Greenville (Miss.) • Houston • Jacksonville • Kalamazoo • Los Angeles Minneapolis • New York • Philadelphia • Pittsburgh • Providence • San Francisco • Seattle • St. Louis Yakima (Wash.) • In Wisconsin: General Chemical Company, Inc., Milwaukee

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

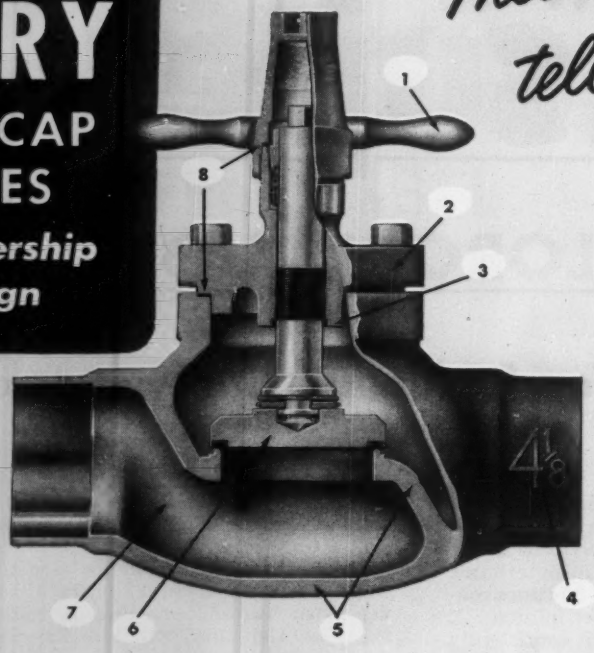
America's Foremost Producer of Fluorine Chemicals

Back of the Unprecedented demand for

HENRY WING CAP VALVES

is a Leadership in design

These features tell the story



1. WING CAP—with stem operating socket.
2. BOLTED BONNET for maximum safety.
3. BACK SEATING—can be repacked under pressure.
4. VALVE SIZE IDENTIFICATION—on Bronze body.
5. HEAVY WALL—Bronze alloy or Semi-steel for maximum strength.
6. PATENTED, NON-ROTATING SELF-ALIGNING SWIVEL DISC. Easy positive sealing. Minimum seat wear. Chatterproof.
7. FULL CAPACITY FLOW THROUGHOUT.
8. FULLY RETAINED POSITIVE SEALING GASKETS.

Available in bronze alloy and semi-steel types. Sizes range: ⅞" to 5⅛" O.D.S. and ½" to 2" F.P.T. Flanged valves available with brass O.D.S. or steel butt weld adapters, sizes 1⅜" to 5⅛".

Year after year Henry Wing Cap Valves become more popular on both government and civilian refrigeration and air conditioning installations because of the high inherent quality of the valves and their features of design and construction. No other similar product carries such a universal recommendation by wholesalers or is in such wide demand among contractors and service men where the use of a wing cap valve is indicated.

HENRY VALVE CO.

Melrose Park, Ill. (Chicago Suburb)

Cable: HEVALCO, MELROSE PARK, ILLINOIS

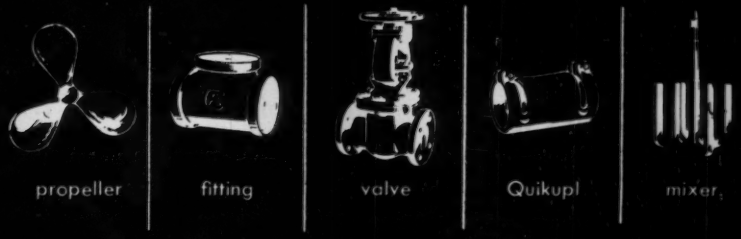
HENRY VALVE CO. CONTROLLING FLOW SINCE 1914 ®

Valves, Driers, Strainers, Control Devices and Accessories for Refrigeration and Air Conditioning and Industrial Applications

DON'T TAKE OFFICE WORRIES HOME

Relax!

Slip on your robe, cuddle up with a good book and forget about the plant. You've done your best today, and you need relaxation to keep on doing your best. If you've specified Cooper Alloy stainless steel castings, valves or fittings for those corrosive operations, you've put your problem in hands you can trust. Our thirty years of experience is your guarantee of quality products—use them with confidence and . . . relax!



propeller | fitting | valve | Quikupl | mixer

COOPER ALLOY

THE COOPER ALLOY FOUNDRY CO. • HILLSIDE, N. J.

Los Angeles, San Francisco, Oakland, Houston, Chicago, Detroit, Philadelphia, Hartford

Leading producers of STAINLESS STEEL valves, fittings and castings

There is **NOTHING LIKE**

Nature's Own Insulation...

The unique character of Cork is nature-made. Principal qualities required for most efficient low temperature insulation are *inherent* in Cork and have established Cork's reputation for utmost efficiency, economy and long-life.

To Cork's nature-made advantages, Mundet adds careful selection and grading of the raw material . . . to be sure that it is the best quality for the purpose. Mundet then fabricates the Cork into the most serviceable forms for commercial refrigeration, air conditioning and other applications of low temperature.

Modern manufacturing methods are only part of the service that Mundet provides to insure maximum satisfaction from use of Mundet Corkboard and Cork Pipe Covering. Through Mundet contract service, we take full responsibility for the proper installation of our products. Let us show how our closely integrated service can benefit you.

There's a Mundet Office near you

ATLANTA, GA.
339 Elizabeth St., N.E.
BALTIMORE 30, MD.
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JACKSONVILLE 6, FLA.
800 East Bay St.—Door 44
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LOS ANGELES, CAL.
(Maywood)
6116 Walker Ave.
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315-325 North Front St.
NEW YORK 17, N.Y.
331 Madison Ave.
PHILADELPHIA 39, PA.
856 North 48th St.
ST. LOUIS 9, MO.
3176 Brannon Ave.

In Canada:
Mundet Cork & Insulation Ltd.
35 Booth Avenue, Toronto

MUNDET CORK CORPORATION
Insulation Division
7209 Tonnelle Ave., North Bergen, N. J.

Without obligation, send me your insulation manual, describing Mundet Cork Insulation Products.

NAME.....

FIRM.....

ADDRESS.....

Mundet Insulation Products include: "Custom-Molded 85% Magnesia Pipe Covering, Magnesia Blocks and Segmented Covertng for Heat Insulation; High Temperature Pipe Covering and Blocks; "Jointite" Cork Pipe Covering and Corkboard for Low Temperatures.

saving for the winter

UTILITY'S COUNTERFLOW FURNACES FOR PERIMETER HEATING

For sheer economy in heating, for real comfort during cold winter months, perimeter heating simply can't be beat.

Utility's Counterflow Forced Air Furnaces were not just adapted for perimeter heating—they were actually designed for that purpose.

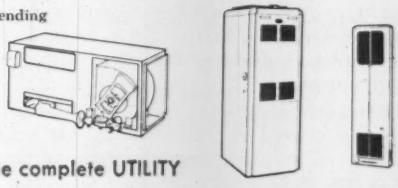
Their oversize blower provides greater power, more effective heat distribution and trouble-free operation. The automatic reset switch further reduces service call-backs.

The Sy-lent* Heat Exchanger keeps noise at its lowest level—an important feature in central hall or closet installations. The ventilating switch provides air circulation during summer months.

These furnaces are approved for zero clearance, sides and rear, and for installation directly on combustible floors.

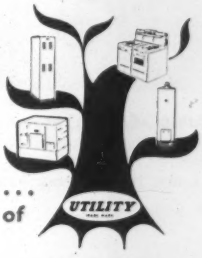
You'll "sell the job" more easily and protect yourself against costly service problems when you choose Utility's Counterflow Forced Air Furnaces. AGA-approved.

*Pat. Pending



See the complete UTILITY heating and air conditioning line now.

GAFFERS & SATTLER
AND OCCIDENTAL
AUTOMATIC GAS RANGES
UTILITY
FURNACES
AIR COOLERS
WATER HEATERS



a happier living family tree . . .
all branches of

UTILITY APPLIANCE CORP., DEPT. HPH-8
4851 S. Alameda St., Los Angeles 58, Calif.

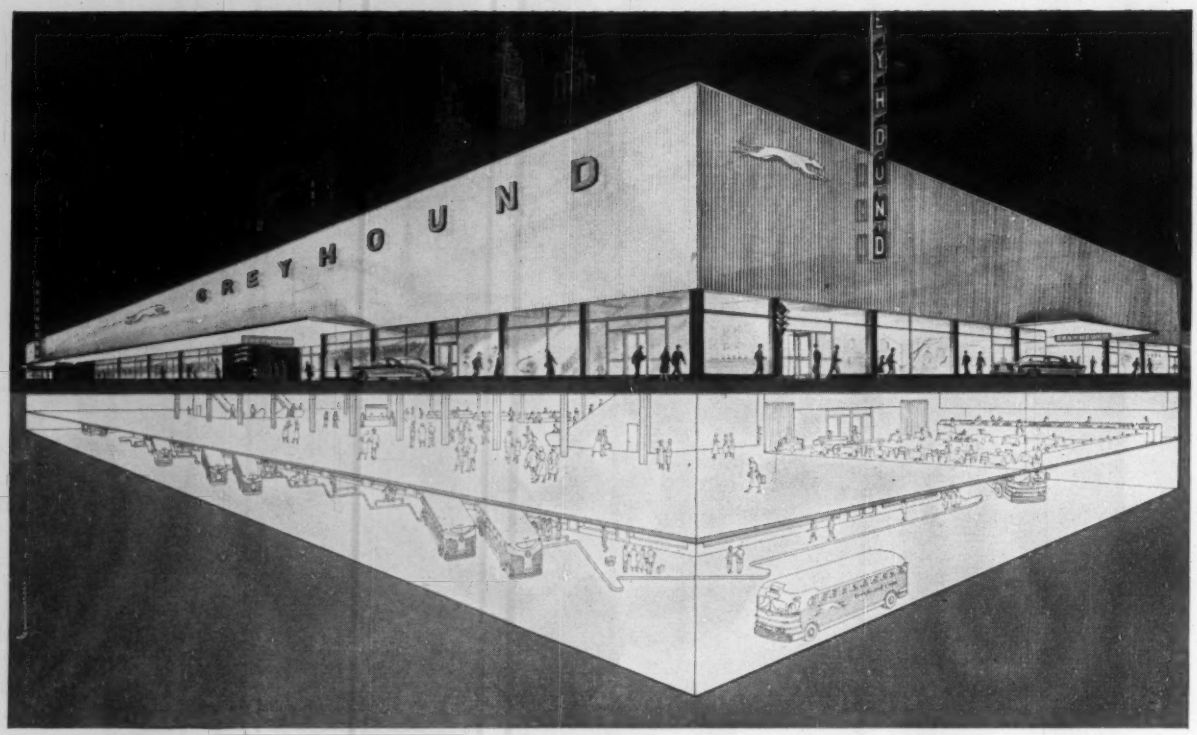
Please send me free information on:

- ☐ Utility Automatic Heating and Air Conditioning Equipment
- ☐ Utility Cooling Equipment
- ☐ Utility Automatic Gas Water Heaters

Name_____

Address_____

City_____ Zone____ State_____



GREYHOUND'S NEW CHICAGO TERMINAL • OWNER: CHICAGO GREYHOUND TERMINAL, INC.

ARCHITECTS-ENGINEERS: *Skidmore, Owings & Merrill, Chicago*
GENERAL CONTRACTORS: *John W. Harris Associates, Chicago*
HEATING CONTRACTOR: *Gallaher & Speck, Inc., Chicago*
VENTILATING CONTRACTOR: *Mehring & Hanson Co., Chicago*

New Greyhound terminal has basement in the "attic"

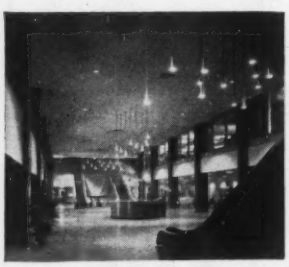
AMERICAN BLOWER equipment helps provide country-fresh conditioned air for Greyhound's unique new Chicago depot

How do you build a bus terminal in downtown Chicago and avoid "Loop" traffic jams? Greyhound used a unique design, with bus tunnels 25 feet below street level. The resulting ventilation problem was solved with American Blower equipment.

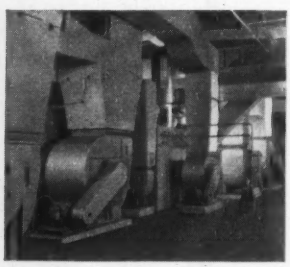
For the bus-concourse level, with its open-ended tunnels, had to be cleared of exhaust fumes — to keep them from filtering up into the air-conditioned waiting room, restaurants and shops.

To overcome this obstacle, and save valuable space, air-handling equipment was installed in the top levels — putting equipment, usually in the basement, up in the "attic." American Blower Fans exhaust fumes and stale air from all levels, and circulate clean, conditioned air — slightly pressurizing the building, and creating an ideal indoor climate.

Perhaps American Blower can help *you*. Each of our representatives is a qualified engineer, with a complete knowledge of air handling and air conditioning equipment—and is prepared to give "on the spot" information.



Modern waiting room is two floors high. Greyhound terminal is geared to handle 120 buses an hour; 18,000 passengers daily.

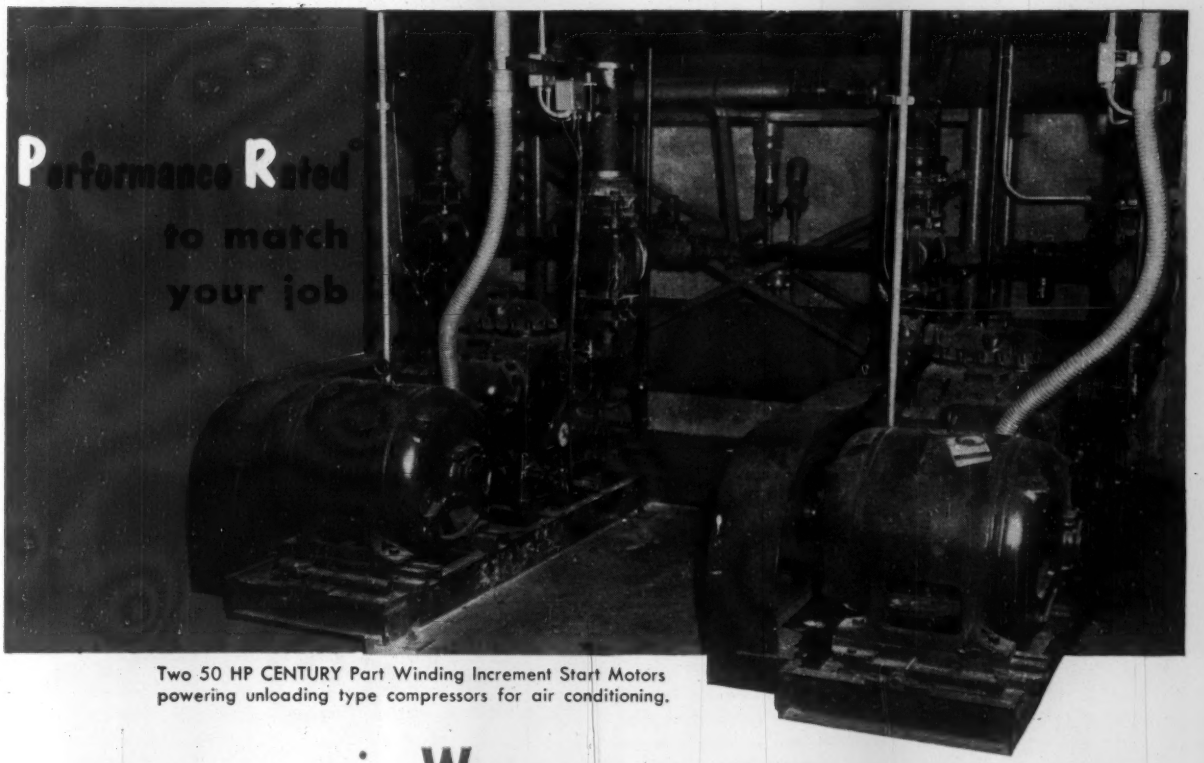


American Blower equipment in this building includes: 22 HS Fans, 9 Air Conditioning Units, Utility Sets and Ventura Fans.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO
Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS



Two 50 HP CENTURY Part Winding Increment Start Motors powering unloading type compressors for air conditioning.

Here's how part winding increment starting works for you:

Motors of the increment starting type operate by electrically separating the motor winding into two parts. One half the winding operates when starting, delivering roughly half the normal starting torque, drawing about one half the normal starting current. After a few seconds the increment starting control connects the second half of the winding into the circuit delivering full torque and current. The three step starter uses a series resistance to further reduce the current on the first step of the starter.

Where you need low starting current . . . you can save with

Century Part Winding Increment Start MOTORS

Starting large motors where there is a limitation on the amount of starting current may be done easily and inexpensively with CENTURY Part Winding Increment Start Motors and control.

Available from stock in all popular sizes, enclosures, and mountings. 1 to 400 HP polyphase.

- **Drip proof**
- **Splash proof**
- **Dust proof**
- **Explosion proof**

HORIZONTAL OR VERTICAL MOUNTING

Because all popular CENTURY Motors have provisions for part winding increment starting, they are available from stock in the complete Performance Rated Century line.

Write for Bulletin 14-157 P.1, or call your nearby Century Distributor or Century District Sales Office.

CENTURY ELECTRIC COMPANY

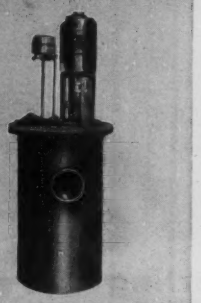
1806 Pine Street · St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

© Performance Rated 1/8 to 400 H.P. Century C MOTORS

830

Get the most from your Pump investment

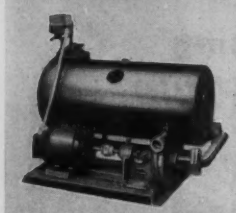


There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough ob.

TYPE UV

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

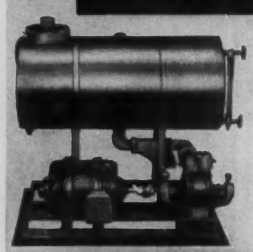
Write for ***Bulletin No. 19-A***



TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

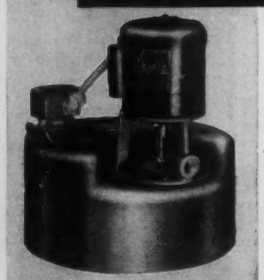
Write for ***Bulletin No. 14-A***



TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

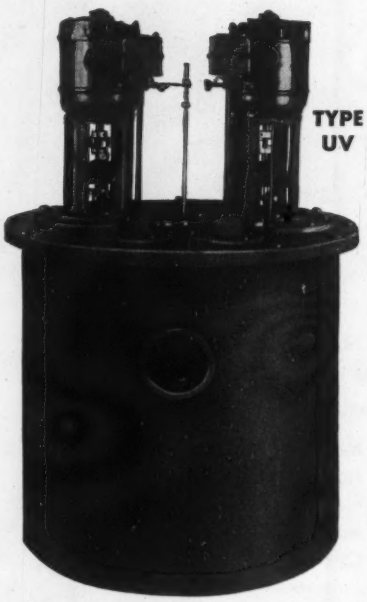
Write for ***Bulletin No. 17***



TYPE CV

Type CV Vertical Pump is ideal where space is limited. This model like every Skidmore Pump is built to meet specific requirements. For the correct solution to your own pump problem consult a Skidmore Heating Pump Specialist.

Write for ***Bulletin No. 21***



TYPE UV

Alert-minded . . . engineers and contractors who are value and maintenance-wise are "all eyes" on Skidmore Pumps. Men *who know* are quick to spot the many advantages that only dependable Skidmore Pumps can offer — whatever your heating pump installation requirement — look at Skidmore *first!*

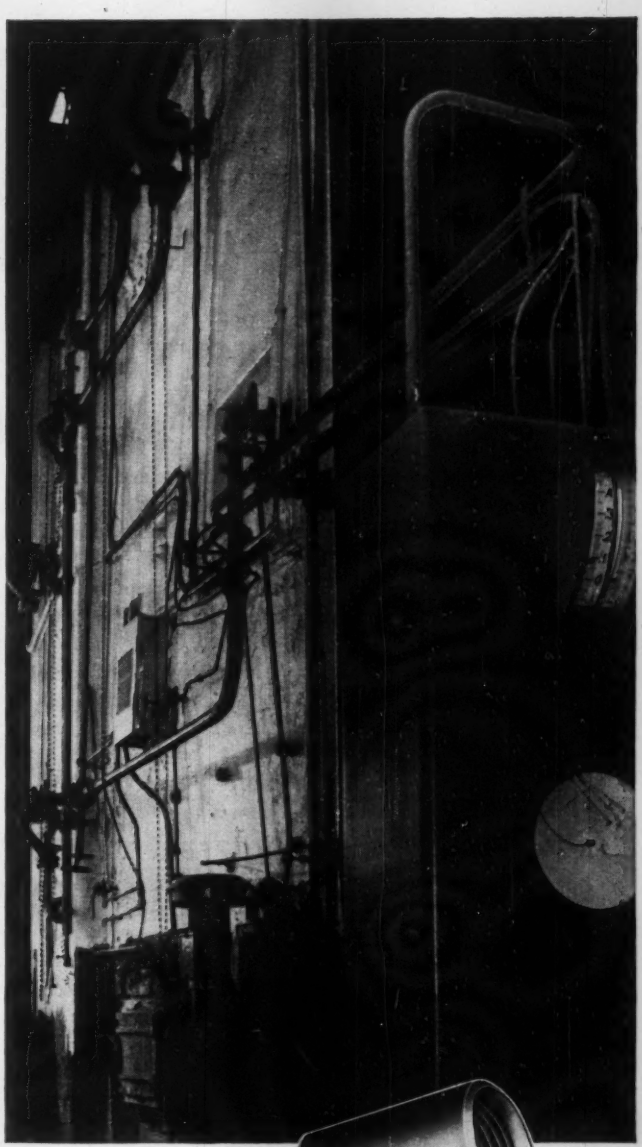
TYPE "UV" — Available in duplex and single units — recommended for below floor level returns. Unit is bolted to sump type receiver. Capacities ranging from 2,000 to 40,000 sq. ft. E.D.R. and discharge pressures from 10 to 75 pounds.

Skidmore Pumps have set a Standard of performance and dependability since 1921

SKIDMORE PUMPS

SKIDMORE CORPORATION
ST. JOSEPH, MICHIGAN

This YOLOY pipe has lasted 6 times longer

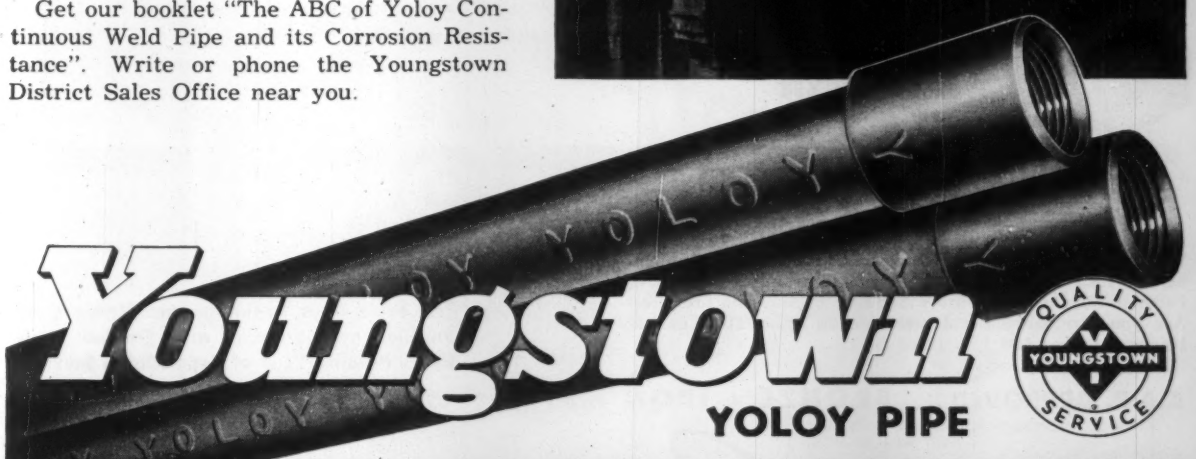


The pipe shown in the photograph of this large boiler carries steam for the "soot" and "fly ash" blower system in an Ohio electric plant. The service is so severe that regular carbon steel pipe had to be replaced as often as 60 days.

A solution for this corrosion problem was obtained by installing Yoloy pipe. Now, twelve months later, the Yoloy pipe is still in service—hasn't developed a single leak. It has lasted six times longer, and looks good for many months more.

Yoloy Continuous Weld Pipe is made from the same nickel-copper steel composition that has proved so successful in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion is of prime importance. It is now available in pipe sizes, from ½" to 4".

Get our booklet "The ABC of Yoloy Continuous Weld Pipe and its Corrosion Resistance". Write or phone the Youngstown District Sales Office near you.



THE YOUNGSTOWN SHEET AND TUBE COMPANY *Manufacturers of Carbon, Alloy and Yoloy Steel*

General Offices: Youngstown, Ohio - District Sales Offices in Principal Cities

SHEETS - STRIP - PLATES - STANDARD PIPE - LINE PIPE - OIL COUNTRY TUBULAR GOODS - CONDUIT AND EMT - MECHANICAL TUBING - COLD FINISHED BARS - HOT ROLLED BARS - BAR SHAPES - WIRE - HOT ROLLED RODS - COKE TIN PLATE - ELECTROLYTIC TIN PLATE - RAILROAD TRACK SPIKES

Quality...

where you need it most

LUNKENHEIMER

POP SAFETY and RELIEF VALVES

Abnormal overpressures are dangerous in any vessel — boiler, compressor, engine cylinder, or pump. That's why you need *outstanding* quality in Pop Safety or Relief Valves that keep overpressures from developing. Not only are they important in preventing interruptions of service — but they may save lives and damage to expensive equipment. That's why it pays to insist on *Lunkenheimer quality* when you specify or buy Pop Safety and Relief Valves for any service. Lunkenheimer design, materials, and workmanship are world-famous for excellence. Their record of performance is unsurpassed.

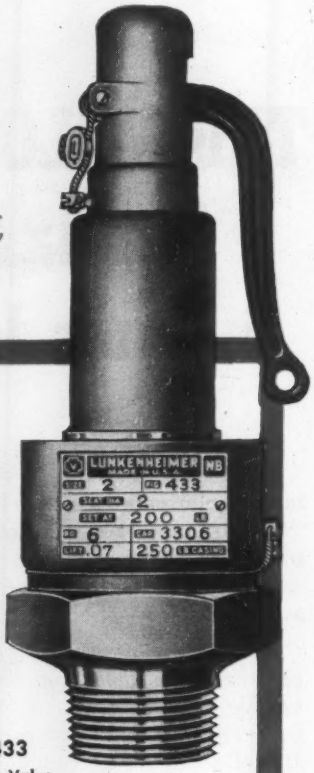


Fig. 433
Pop Safety Valve

THE DIFFERENCE BETWEEN POP SAFETY AND RELIEF VALVES

Pop Safety Valves are used in conjunction with gases, including steam. They pop wide open when the set pressure is reached, stay open until pressure has dropped . . . then snap shut instantly. **Relief Valves** are used in conjunction with liquids. They start to open at the set pressure but require about 20% overpressure to open wide. As pressure drops, they start to close and shut tight when the set pressure has been reached.

Fig. 658
Relief Valve

LUNKENHEIMER
L
QUALITY

WRITE FOR CIRCULAR 502, which describes the complete Lunkenheimer Line of 21 different Pop Safety and Relief Valve Patterns, each available in a wide range of sizes and pressures. Ask your Lunkenheimer Distributor or write The Lunkenheimer Co., Box 360, Cincinnati 14, Ohio.

The Price of a Lunkenheimer Valve Gets Smaller and Smaller and Smaller with Every Passing Year of Dependable Service.

A.A.R. APPROVED **BRONZE • IRON • STEEL**

LUNKENHEIMER®

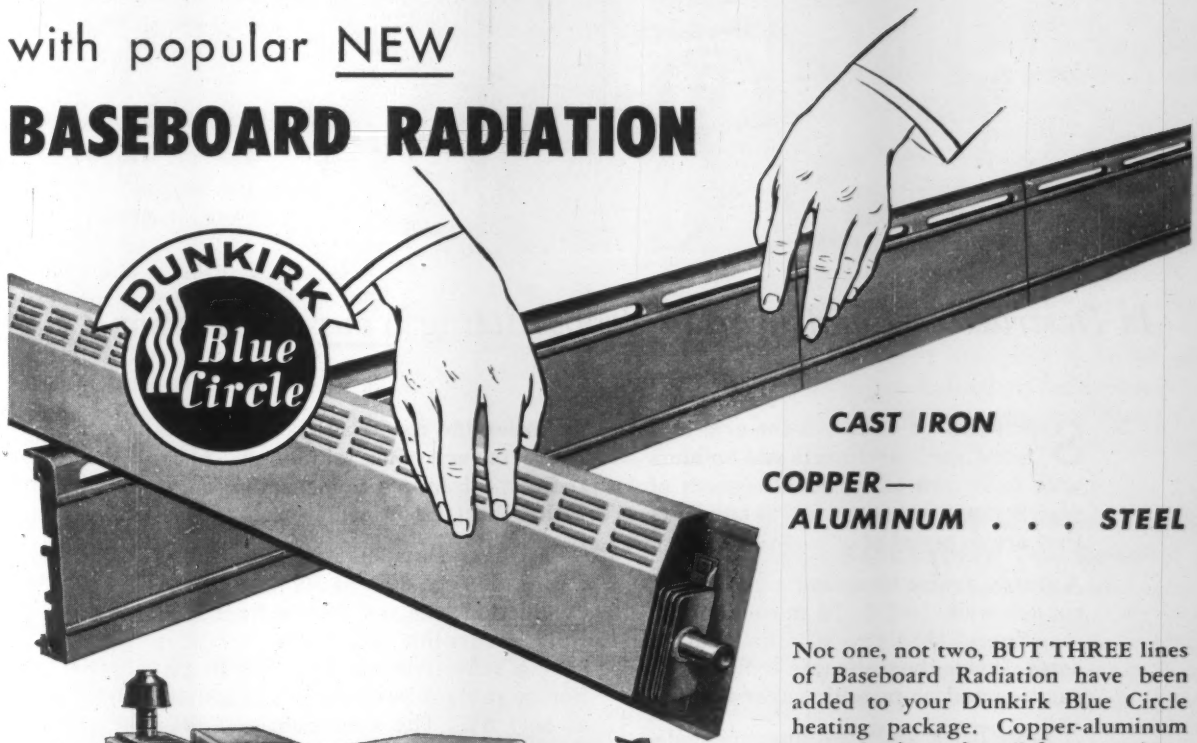
THE ONE *Great* NAME IN VALVES

...and now **DUNKIRK**

completes your package

with popular NEW

BASEBOARD RADIATION



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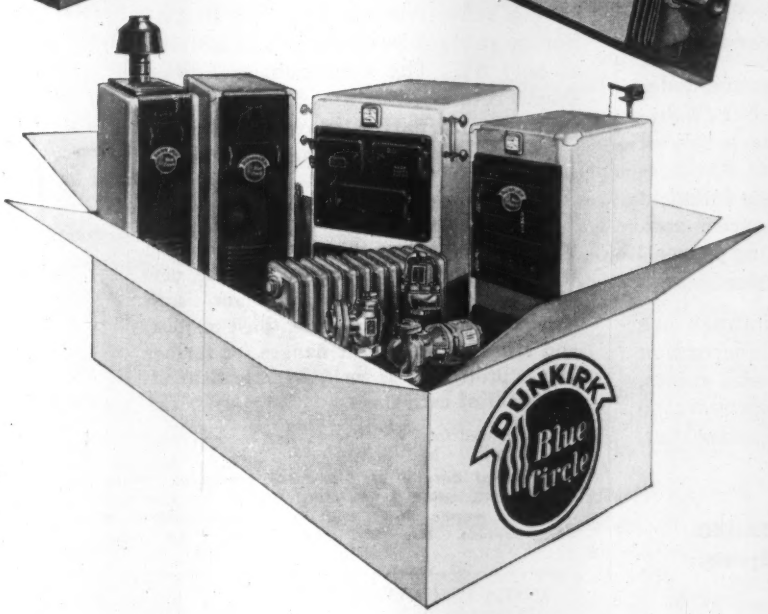
ALUMINUM . . . STEEL

Not one, not two, BUT THREE lines of Baseboard Radiation have been added to your Dunkirk Blue Circle heating package. Copper-aluminum ...steel tube and steel fin...cast iron, —you now have a 3-way choice of Dunkirk Blue Circle Baseboard Radiation to fit every job.

The Dunkirk Blue Circle package now combines Boilers, Radiation and Accessories for modern gas, oil and coal fired steam and hot water heating systems.

Designed right, built right, priced right.



Write and discover how it pays to do business with Dunkirk.

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DUNKIRK, NEW YORK

Send New Baseboard Catalog.

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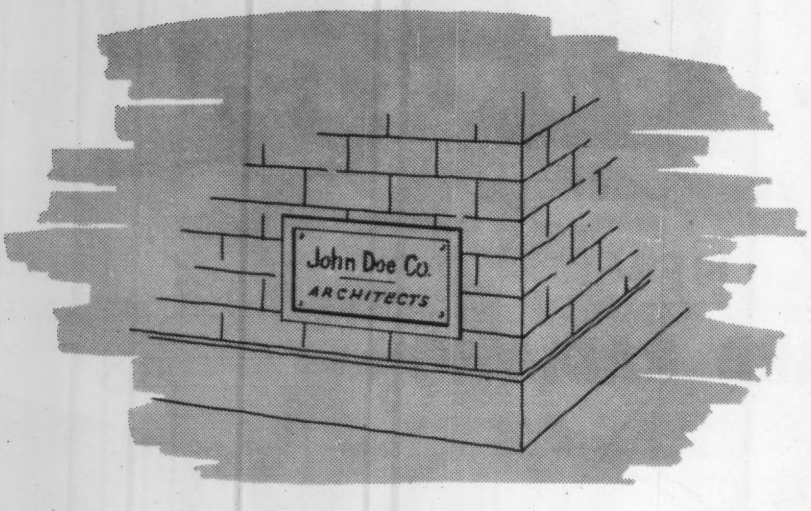

Is Destructive Condensation Jeopardizing Your Reputation?

SPECIFYING on a "take-it-for-granted" basis, some architects and builders with their own hands sow the seeds of destruction inside the walls of buildings they are so proud of.

A sturdy, frame house in Pennsylvania, for example, had to be moved. But it was found that the sills had rotted away. Inside the walls was ordinary insulation and no metallic vapor barrier.

A large brick and steel apartment development in the suburbs; a huge housing project in a big city; each caused great expense to its sponsors when ordinary insulation inside walls failed to prevent excess vapor flow, excess condensation formation, resulting in peeling paint and crumbling plaster.

Reputations as well as buildings are guarded by the use of multiple accordion aluminum. Its continuous metal sheets, 500 ft. to 750 ft. long, are impervious to water vapor. Infiltration under flat, stapled flanges is slight.

COST OF INFRA INSULATION INSTALLED
in new construction between wood joists, material with labor,

Type 6-S under 9½¢ sq. ft.
Type 4-S under 7½¢ sq. ft.

INFRA INSULATION, INC., 525 Bway., New York, N. Y. WOrth 4-2241

The scientific construction of multiple layers of accordion aluminum, fiber, and air, minimizes condensation on or within this type of insulation.

Of all heat flow through structural spaces, 50% to 80% is Radiation; 7% Conduction; the rest Convection. Multiple accordion aluminum surfaces have a reflectivity of 97% for Radiation or radiant heat, and an emissivity of only 3%. The aluminum and fiber sheets retard outer and inner Convection. The alternating layers of air spaces have low density and therefore slight Conduction.

To obtain maximum uniform depth protection against heat loss and condensation formation, it is necessary to use the new edge-to-edge multiple* aluminum, each sheet of which stretches from joist to joist, and also all through the flanges for further vapor protection as well as permanent attachment of each sheet.

*Patent applied for

A National Bureau of Standards brochure: "Moisture Condensation in Building Walls" interestingly discusses vapor flow, and causes and control of Condensation. Use the coupon for free copy.

INFRA INSULATION INC. H-7
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THE EDITORS' PAGES

• *ANOTHER HAZARD of modern life was demonstrated last month to a television audience when some "he-man language" not intended for home consumption was broadcast. A maintenance crew was trying to locate a noise in the studio air conditioning system, and the undoubtedly necessary conversation required to do so went on the air along with the scheduled program.*

Construction Continues at Record Levels

. . . contract awards show

JUNE CONTRACT awards for future construction in the 37 eastern states were "substantially" above those for the corresponding month of 1953, F. W. Dodge Corp. reports.

Dr. George Cline Smith, Dodge economist, said that tabulations completed through June 22 had already exceeded the total for the entire month of June 1953. The contract awards reported for all of June '54 totalled $1,733,264,000, compared with the total of $1,116,000,000 reported in all of June 1953, he said.

"Thus, the high levels of contract awards which have been an outstanding feature of the economic scene all through this year are continuing. Since contract awards precede actual construction activity, we may expect the construction industry to operate at or near record levels for the next several months at least," he stated.

Contract awards in May for future construction in the 37 eastern states set "phenomenal" new records. The May total was the highest monthly total in Dodge's 63-year history.

Air Conditioning Boosts Workers' Efficiency

. . . manufacturer finds

SPECIFIC figures on the efficiency-boosting value of air conditioning in an office or a plant are usually difficult to come by. Records of efficiency generally aren't available — much less comparative data before and after installing air conditioning.

But such figures aren't necessary to prove air conditioning's advantages to Eugene R. Kulka, president of Kulka Electric Mfg. Co., Inc., manufacturers of electrical wiring devices in Mount Vernon, N.Y. Kulka installed air conditioning in its plant last year — and Mr. Kulka writes that they "are very much pleased with it as it has increased the efficiency of employees." He feels that the air conditioning "has already more than paid for itself.

"The latter part of August and the first part of September last year were terrifically hot, with the days ranging in temperature from the top 90's to the low 100's," Mr. Kulka says. "We did not send one person home nor did anyone stay away. In fact, 90 percent of our workers insisted on working overtime because it was very much cooler at the plant than outside or in their homes. In previous years, we had to shut our plant down on very hot days and send people home during the afternoons. When you have over 200 people employed, and at the present high cost of labor, this is decidedly an expensive proposition both from the production, overhead and labor points of view.

"Because of the air conditioning, we find that we have less absenteeism due to illness or respiratory troubles. We find that the air conditioning in the plant makes quite a difference in the type of work produced and in all-around efficiency," he concludes.

See Sharp Upturn in Heating Sales

. . . at IBR meeting

THAT THE FALL of 1954 will see a sharp upturn in the sale of hot water and steam heating equipment which is likely to last until 1960 was the prediction voiced at the annual meeting of the Institute of Boiler and Radiator Manufacturers.

The meeting was the largest in the IBR's history from the standpoint of attendance. Discussions during the three-day session covered the research program in heating and cooling at the University of Illinois, short courses there and at Purdue, the IBR school of modern heating, two new proposed IBR installation guides, the appointment of a new technical secretary, and the inauguration of a new public relations program.

Robert S. Waters, chairman of the board of the National Radiator Co., chairman of the institute, presided. Mr. Waters was re-elected chairman and H. F. Randolph was re-elected vice chairman. Mr. Randolph is president of the International Heater Co. R. E. Ferry is general manager and treasurer of the IBR.

How Many of These Books Have You Read?

. . . list for engineers

A PROGRAM designed to stimulate additional interest in selected reading on the part of young graduate engineers has been embarked upon by the Engineering Society of Cincinnati in conjunction with the Cincinnati and Hamilton County Public Library.

A collection of 80 selected volumes from the "Reading List for Young Engineers" has been furnished by the public library. These books will be placed on a loan basis in the library of the Herman Schneider Foundation building, which is headquarters for engineering society activity in the Cincinnati area.

This activity is part of a pilot-study project of the Engineers' Council for Professional Development to determine what aspects of community life can be of assistance and inspiration to young engineers in their personal and professional growth during the first few years after graduation from college.

The over-all program, known as "The First Five Years of Professional Development," aims to stimulate the

young engineer in the period when he is learning to grow on his own initiative.

The recommended reading program is based on the concept that the two most important attributes of a professional man are the ability to deal with men and affairs, and the ability to read and absorb the written experience of others.

Authors included in the collection of 80 books in the humanistic-social fields are:

AUTHOR and TITLE

Asch, Sholom — The Apostle
Bakke, W. W. — Mutual Survival
Balzac, Honore de — Old Goriot
Balzac, Honore de — Droll Stories
Baxter, J. P. — Scientists Against Time
Beard, C. A. & Mrs. M. — Rise of American Civilization
Beebe, William — Galapagos
Brooks, Van Wyck — The Flowering of New England
Browne, Lewis — This Believing World
Buck, Pearl — The Good Earth
Bulley, M. H. — Simple Guide to Pictures & Painting
Burlingame, Roger — March of the Iron Men
Butler, Samuel — The Way of All Flesh
Carrel, Alexis — Man the Unknown
Cellini, Benvenuto — Autobiography
Chaucer, Geoffery — The Canterbury Tales
Cheney, Sheldon — A World History of Art
Childs, Marquis — Sweden, the Middle Way
Churchill, Winston — The Eastern Front
Churchill, Winston — My Early Life
Clemens, S. L. — Tom Sawyer
Conrad, Joseph — Lord Jim
Cronin, A. J. — Keys of the Kingdom
Dana, R. H. — Two Years Before the Mast
DeKruif, Paul — Microbe Hunters
Dennison, Henry — Organization Engineering
Dickens, Charles — David Copperfield
Dos Passos, John — U.S.A.
Dostoyevsky, Feodor — Brothers Karamazov
Douglas, Lloyd — The Robe
Douglas, Norman — South Wind
Dreiser, Theodore — An American Tragedy
Durant, Will — The Story of Philosophy
Eisenhower, D. D. — Crusade in Europe
Forbes, Esther — Paul Revere and the World He Lived In
Forster, E. M. — A Passage to India
France, Anatole — Penguin Island
Freeman, Douglas — Robert E. Lee; A Biography
Galsworthy, John — The Forsyte Saga
Goldsmith, Oliver — The Vicar of Wakefield
Graves, Robert — I, Claudius
Gunther, John — Inside U.S.A.
Haldane, J. B. S. — Adventures of a Biologist
Harding, C. F. — Business Administration for Engineers
Hardy, Thomas — The Return of the Native
Hemingway, Ernest — For Whom the Bell Tolls
Hogben, Lancelot — Science for the Citizen
Holden, P. E. & Smith, H. L. — Top Management Organization & Control
Ibsen, Henrik — An Enemy of the People; The Wild Duck
Lamb, Harold — Alexander of Macedon
Lewis, Sinclair — Arrowsmith
Lynd, R. S. & H. M. — Middletown in Transition
Mann, Thomas — I Believe
Marx, Karl — Capital
Maugham, Somerset — The Moon and Sixpence
Melville, Herman — Moby Dick
Mencken, H. L. — The American Language
Montaigne, M. E. — Essays
Orpen, Sir William — Outline of Art
Overstreet, H. A. — The Mature Mind
Palgrave, F. T. — The Golden Treasury
Pearson, Karl — The Grammar of Science
Roberts, Kenneth — Rabble in Arms
Robinson, James H. — The Mind in the Making
Russell, Bertrand — History of Western Philosophy
Saint Exupery, Antoine — Wind, Sand and Stars
Scheinfeld, Amram — You and Heredity
Sherwood, R. E. — Roosevelt and Hopkins; An Intimate History
Stefansson, Vilhjalmur — Northward Course of Empire
Steffens, Lincoln — Autobiography
Steinbeck, John — Grapes of Wrath
Steinman, D. B. — Bridges and Their Builders
Tolstoi, L. N. — War and Peace
Toynbee, Arnold — A Study of History
Van Doren, Carl — Benjamin Franklin
Wells, H. G. — Outline of History
Wells, H. G. — The Time Machine
Whitehead, A. N. — Science in the Modern World
Whitman, Walt — Leaves of Grass
Zinsser, Hans — Rats, Lice and History

"Quote"

"Every progressive industry has technical problems and opportunities; only dead industries do not."—*Elmer R. Kaiser, formerly Assistant Director of Research of Bituminous Coal Research, Inc., and now Director of Research of the American Society of Heating and Ventilating Engineers, in a paper published in* 1950.

Window A.C. Units Must Be Registered

. . . D. of C. rules

ACCORDING to an amendment made earlier this year to the 1951 electrical code of the government of the District of Columbia, "all self-contained window air conditioning units, both air and water cooled, including but not limited to console or sill type, installed in hotels, tenement houses, apartment houses, convalescent homes, rooming, boarding and lodging houses, shall be registered with the Superintendent, Division of Inspections, Department of Licenses and Inspections."

The code further specifies that, "for the purpose of computing circuit loading and grounding requirements, all self-contained window air conditioning units shall be considered to be fixed equipment," and that "the total rating of window air conditioning units shall not exceed 50 percent of that branch circuit rating if it also serves lighting units or appliances. However, a window air conditioning unit served exclusively by a separate circuit shall not exceed 80 percent of that branch circuit rating. One hundred and twenty volt individual window air conditioning units rated in excess of 7.5 amperes shall be supplied by a separate branch circuit of not smaller than No. 12 conductors, except that existing circuits of less than No. 12 conductors properly fused with 15 ampere type S fuses may be approved by the Superintendent, Division of Inspections, for units served by such circuits. If a receptacle outlet exceeding 150 volts between conductors is installed, it shall be of the 3 pole type grounded. Receptacles connected to individual branch circuits shall have a rating of not less than the rating of the branch circuit."

"Record-Breaking" Years for Air Conditioning Seen

. . . more capacity needed

THE AIR conditioning industry "can look forward to at least five sales-record-breaking years," stated C. E. Buchholzer in a recent discussion on the outlook for air conditioning.

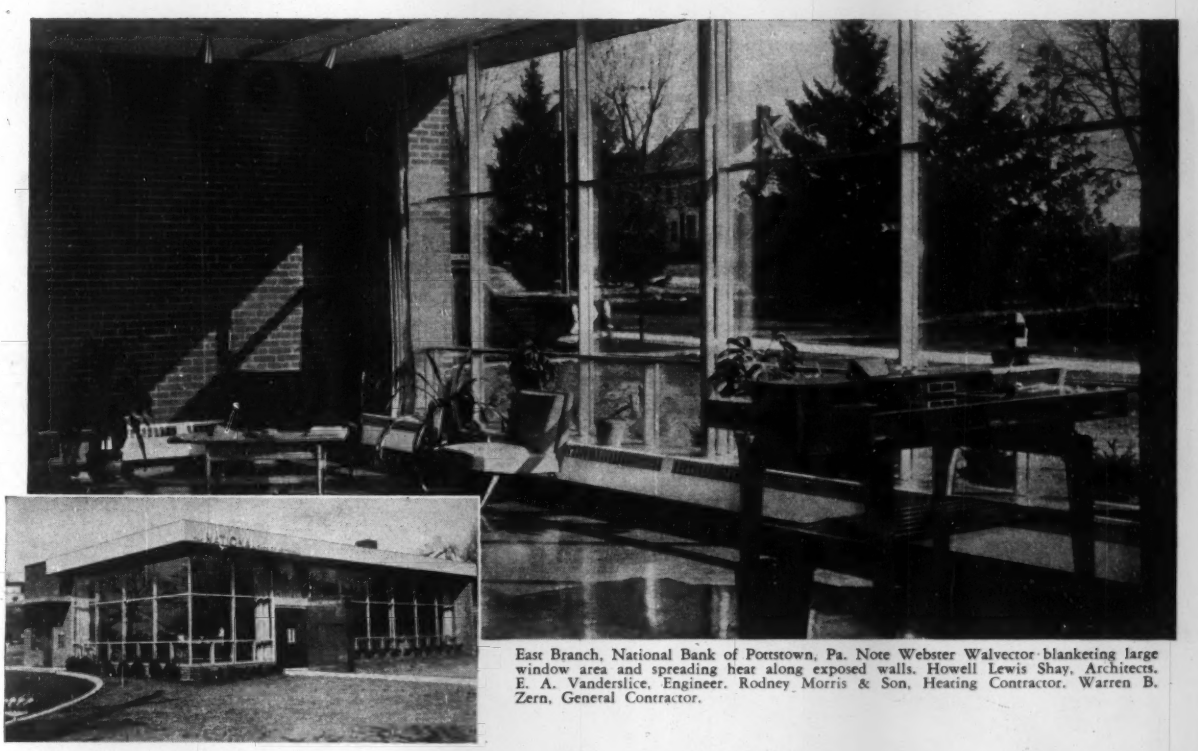
"Our business is at the point now where companies must cease the 'make do' efforts to increase capacity as surging sales demand, and invest heavily in new plants, equipment, better production techniques and more flexible service training techniques.

"In all probability, the air conditioning industry will surpass the $2 billion business volume mark this year. At its present rate of annual increase, the industry should top the $4 billion record by 1958," the Chrysler Airtemp president predicted, in conclusion.

High Velocity System Uses Class III Fans

. . . for supply

AS POINTED out in the article in the July HPAC on the high velocity system for the electronics supply office building at the Great Lakes, Ill., naval station, Class III fans (now known as heavy duty, Class II) were selected for supply. However, the fan shown in the illustration on page 88 of the July issue is a general purpose fan, which is used for exhaust service in this installation.



East Branch, National Bank of Pottstown, Pa. Note Webster Walvector blanketing large window area and spreading heat along exposed walls. Howell Lewis Shay, Architects. E. A. Vanderslice, Engineer. Rodney Morris & Son, Heating Contractor. Warren B. Zern, General Contractor.

Air Conditioning AND Tru-Perimeter Heating . . .

A good team for COMFORT all year long!

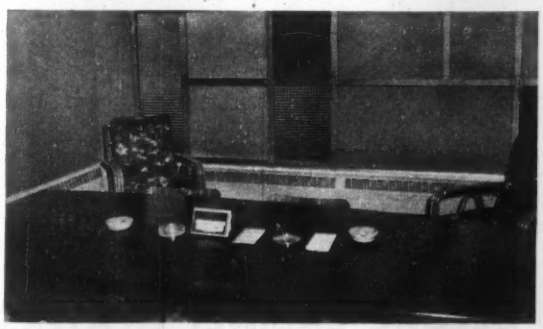
Twin branch banks team complete air conditioning with winter-long comfort of forced hot water Webster Tru-Perimeter Heating.

Whether it's the dog days of summer or the polar bear months of winter, there's complete comfort inside the new, matching East and West Branches of the National Bank of Pottstown, Pa. That's because Howell Lewis Shay, Architects, designed them with comfort in mind . . . specified air conditioning *plus* forced hot water Webster Tru-Perimeter Heating.

Trim, attractive Webster Walvector, tucked beneath the large window area and along all exposed walls, carries forced hot water heat around the perimeter of the building . . . replaces heat where heat loss occurs . . . spreads heat gently and evenly for draft-free comfort.

Webster Walvector in Tru-Perimeter Heating is economical to install and maintain. Simplified piping is easily accessible . . . fewer risers are needed. Heating up is quick, and effectively controlled.

Webster Tru-Perimeter Heating with series-connected Webster Walvector uses forced hot water or Moderator controlled low-pressure steam. For further information, call the Webster Representative or write us.



Webster Walvector with forced hot water gives Tru-Perimeter Heating comfort in the bank's Conference Room, offsets heat loss beneath multi-colored glass paneling.

Address Dept. HP 8

WARREN WEBSTER & COMPANY

Camden 5, N. J. :: Representatives in Principal U. S. Cities

In Canada, Darling Brothers, Limited, Montreal

Webster WALVECTOR

REG. U. S. PAT. OFF.

For Steam or Hot Water Heating

AND **Webster Heating Equipment also includes Webster Baseboard also used in Tru-Perimeter Heating; Convectors; Steam Heating Specialties for heating and process applications; Webster Moderator Systems of Steam Heating and continuous flow controls for hot water heating — both with Outdoor Thermostat; steam, hot water and gas Unit Heaters. Data on request.**

Have you seen the new Nesbitt Series C unit heater?

IT'S GOT EVERYTHING WE'VE WANTED...

FREE-STANDING

"Nesbitt's new Publication 403 just arrived and it shows their complete line of deluxe cabinet unit heaters . . . and, Boss, they sure are beauties! Why,—"

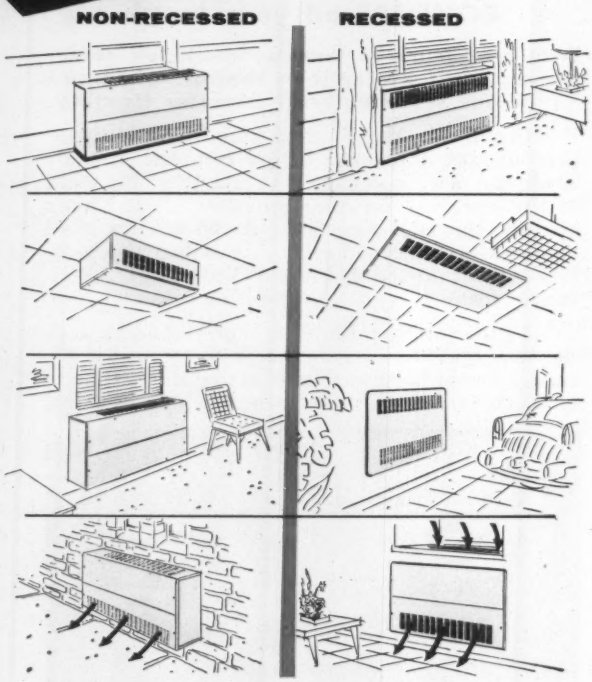
"Yes, Harry, I—"

"you know, Boss, this is the most flexible line of unit heaters I've ever seen. What a range of capacities—in both steam and hot water! The small direct-drive unit handles from 269 to 413 c.f.m. and gives from 17,700 to 35,100 B.t.u. per hour. The larger belt-drive units, with two to five fans, range from 342 to 1885 c.f.m., standard air, and from 24,000 to 148,000 B.t.u.—"

"Yes, Har—"

"But best of all, Boss, you can mount them any way you want—floor, horizontal, wall, or inverted—and free-standing, semi-recessed two ways, or fully recessed. The discharge or intake can be face, top, or bottom—direct or with ducts. The casings have fronts that conceal the rough opening to save plastering headaches. And you know Nesbitt construction!—I think these are just the units we need for that new—"

"HARRY! I've been trying to tell you . . . I received the new publication, too, and I've already sent you a memorandum to use Nesbitt Series C's on the terminal job!"



Nesbitt SERIES C DELUXE CABINET HEATERS

Manufactured and Sold by John J. Nesbitt, Inc., Philadelphia 36, Pa. • Send for Publication 403

"OPEN FOR DISCUSSION"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

G. W. TOMPKINS —

"Why Not Reset the Gage?"

REFERRING to Bill Dopp's article, *Operating Man Accuses Stop-Check Valves Falsely*, in the June HPAC, I am wondering why not save time, trouble and steam by resetting the gage on the boiler to compensate for the 17 lb water column instead of installing the trap as suggested?

Bill Dopp's articles are your most enjoyable feature, as far as I am concerned.—G. W. TOMPKINS.

THE AUTHOR REPLIES — Thank you for the opportunity to answer Mr. Tompkin's question about my article in the June HPAC. He has proposed a very simple and apparently satisfactory solution to the problem of getting a correct gage reading. This was not the main problem of the article but it is an interesting question that is worthy of some thought.

In the first place, he makes the assumption that the condensate level in the pipe will be constant. With a widely fluctuating load, such as we have here, is this necessarily true? To make the adjustment of the gage, it would be necessary to place a gage on the boiler drum and to set the false reading of the lower gage to compensate for the water that had actually accumulated in the pipe at that particular time. Should the amount of water for any reason change, the false reading would be doubly false. So this short cut, like others, can lead to serious trouble.

The purpose of a gage on a boiler is twofold. One of these is to inform the operator of the pressure in the boiler, and the other is to guard the equipment from the effects of excessive pressure. It is therefore definitely a safety measure. Its installation and maintenance must be based upon this fact.

Mac has repeatedly warned that safety devices of any kind should be installed with great care and must be constantly inspected to be sure that they are working properly. Obviously he could not subscribe to the practice of falsifying one of the main safety devices in the plant. Paul Vance was getting a false reading, but he did not know it until Mac pointed it out to him. Why, then, deliberately introduce a false reading just as unreliable, or more so, to save a few dollars in the cost of a trap and the use of a little steam? Mac says no. Let's stick to facts, particularly with the instruments that we use. — BILL DOPP.

KALMAN STEINER —

"Should Oil Be Defined as 'Cold' or 'Hot' "?

As I WAS among those who attended the panel session at the recent convention of the Oil-Heat Institute which is reported in the article, *Burning the Heavier Oils*, as published in the July HPAC, I feel impelled to add a few words of comment.

Refiners claim they need wide latitude in fuel oil specifications if they are to produce the heavier oils economically enough to offer them at attractive prices. Such wide limits in specifications, of course, bring hardship to the contractor and his customer. For many years, No. 5 fuel oil was considered to be a product capable of being burned cold, and Underwriters' Laboratories approved and listed many burners as being able to burn cold No. 5 oil. Then when Commercial Standard (CS 12-48), *Fuel Oil* came along, No. 5 fuel oil was proclaimed to be an oil requiring preheating, and the viscosity limit was raised considerably. Possibly the refiners needed this wider range so that they would not have to sustain extra costs in tailoring a fuel oil to meet close specifications.

Perhaps if refiners were held to close limits, the production costs would rise and make the price of fuel oil no longer competitive with other fuels. However, if these are the facts that the contractor must face, then the old system of numbering fuel oil might well be abandoned in favor of the words, "cold" and "hot." A contractor would then know whether he is to install equipment to burn an oil that flows freely at all times without the benefit of preheat, or whether he must equip his burner with preheaters capable of keeping the oil fluid through increase in temperature. — KALMAN STEINER, Engineer, C. Hoffberger Co.

J. F. GSCHWIND —

"HTHW Article Is Excellent"

THE ARTICLE, *HTHW System Serves Personal Products Plant 13 Years* by Lewis Smith and Steven Senko, published in the July HPAC, is excellent. The authors have done a commendable job in furnishing descriptive as well as operational data on this system. There are quite a few other such installations that are performing equally as well and were designed and erected in the early '40's. However, complete information on the operation of these other HTHW systems has not been made available previously, to my knowledge.

It may be of interest to note that technological progress in the HTHW field has advanced and kept step with many applications. Some of these include the newest design features and improved equipment which insure even higher efficiencies. Also, the flexibility of recent installations is much greater when compared with prewar systems. — J. F. GSCHWIND, Manager, Supertherm Dept., J. O. Ross Engineering Co.

HAROLD W. ALYEA —

"Here's My Reply to Mr. Smith's Comments"

HERE'S MY reply to Lewis Smith's comments in the July HPAC about my four articles, *How to Control Unit Ventilators in School Buildings*, which appeared in the October, 1953 HPAC and the three following issues.

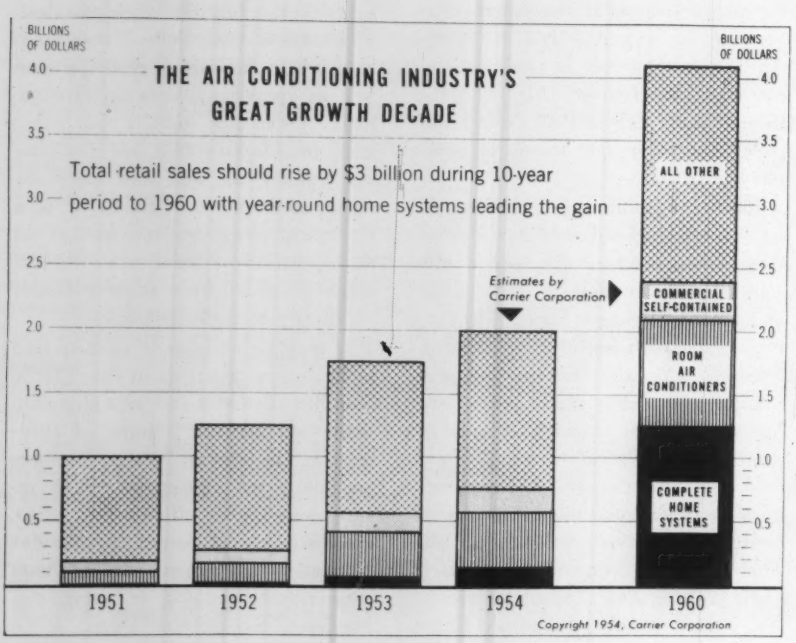
I can agree with Mr. Smith's comments only to the extent that a good continuous flow zone control system, as an adjunct to normal unit ventilator controls, can contribute to control stability. While I am not questioning Mr. Smith's statement that "there are systems which never give intermittent flow, no matter what the weather", I have never seen one. In view of the known difficulties of providing good steam distribution in mild weather without resorting to intermittent operation, there is a serious question whether the results are worth the expense and effort.

Mr. Smith proposes a method of modulating the steam system accurately enough to eliminate the control valves on the individual unit coils, obtaining control by operation of the dampers only. Even if this would meet the state codes governing ventilation requirements, to my knowledge it has not been satisfactorily demonstrated that this arrangement would provide a sufficient range of control to produce uniform space temperatures. Such a system is predicated on the assumption that the zone control system can accurately account for variations in outdoor temperature, solar gain, wind, etc., for a complete zone. These variables, together with other factors such as variations in shading over parts of a zone due to adjacent structures, or protruding parts of the same structure, make it difficult to achieve the precise results that Mr. Smith's system would require unless the zones are quite limited in extent and correspondingly larger in number.

It does not seem to me wise to add the many problems and difficulties of zone control to a unit ventilator system merely to accomplish the elimination of the unit ventilator valves, especially in view of the restrictions on the range of control which the room thermostat could provide with this system, the loss of flexibility to meet unusual room conditions, and the need for meeting various state ventilation codes.

Mr. Smith's comments imply that my articles attributed faulty control in part to lack of a constant differential across the control valve. This is not true, as reference to the articles will verify. For many years good automatic control valves have been equipped with throttling plugs or V-port skirts which are designed to provide the desired flow characteristics, taking into account the increasing differential as the valve closes. If such were not the case, some kind of differential pressure control would be just as necessary on all other control applications involving steam flow as Mr. Smith claims it is on unit ventilator installations. While automatic control valves are designed to accommodate changes in differential which result from the throttling action of the

Forecasts Big Growth



HOW DOES THE future look for the fast-expanding air conditioning industry?

By 1960, *at the close of its greatest decade of growth, approximately one out of every five homes and apartments in the country will be equipped with complete or partial air conditioning . . .*

The year 'round air conditioning of homes will have become the largest single part of the entire business, with further sharp increases still to come. . . .

The second biggest market will be installations in industrial plants to provide greater working efficiency in order to bring higher quality goods to the American public at lower prices.

These are the predictions of Cloud Wampler, president of Carrier Corp. and a leading spokesman for the industry.

valve itself, they cannot correct for such changes that are due to variations in the supply pressure. My articles simply called attention to the fact that such changing supply pressures exist on too many jobs, and offered the suggestion of a pressure reducing valve as a remedy.

Given a reasonably constant steam pressure and correctly sized valves, the conventional controls normally used with unit ventilators have for many years produced good results. It seems to me that Mr. Smith's suggestion of adding zone control, with all of the attendant complications and expense, is in the direction of "piling control on control" rather than simplification, as he claims.

Where there are variable factors which adversely affect the controls, or because of excessive lags as enumerated in the articles, the master-submaster method of control was suggested. Contrary to Mr. Smith's impression, this adds practically no complication to the control system. There is a thermostat in the unit anyway, used only as a low limit. All that this new system requires is to change it to a submaster so that it functions all of the time. No other changes are required.

I believe a simplified zone control system, properly used, has some merit when used in conjunction with normal unit ventilator controls. I would not try to modulate such a system to provide complete control of the steam supply, and thus would avoid most of the difficulties and complications. If such a system were modulated from a temperature of 218 F — 2 psig — at design conditions, to a temperature of 150 F — 22.4 in. Hg. vacuum — at 65 F outdoors, and used in conjunction with a high capacity high vacuum pump controlled so as to maintain a differential between supply and return so as to insure good distribution without the use of orifices or other complications, this would result in a sizable reduction in capacity of the steam system as the weather moderates. It would make sizing of the control valves much less critical and would improve control stability. Furthermore, since complete control of the final space temperature would still be accomplished by the room thermostat, precise zoning would not be required, there would be fewer zones, and the zone controls would be simpler. Such a system would provide most of the savings in line losses mentioned by Mr. Smith, and would also provide a fair amount of control in otherwise uncontrolled spaces. — HAROLD W. ALYEA, Chief Field Engineer, Johnson Service Co.

LESTER T. AVERY —

"Congratulations on 25th Anniversary"

CONGRATULATIONS to HPAC on its 25th anniversary! I enjoyed the May anniversary issue very much with articles by some of my old pals — I. W. Cotton and others.

I did not realize that HPAC broke out of its shell in 1929 as did Avery Engineering Co. We have survived 25 chaotic years. We have seen the air conditioning business develop as such in those 25 years. The low

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for Air Conditioning

"In the increasingly competitive economy of today, air conditioning is becoming an essential to improved productivity," says Mr. Wampler. "Among other advantages, it provides employees with relief from heat and humidity, enabling them to work comfortably and efficiently, with a resulting overall reduction in production costs per unit.

"We are already beginning to see the start of this trend. For example, in textile production — one of the most completely air conditioned industries in the country — most of the past installations in spinning and weaving plants were designed to establish a constant humidity at fairly high levels because of the special characteristics of the fibers. But these systems did not provide positive temperature control.

"In the drive to improve production, there was introduced more automatic machinery and more intensive lighting, both of which contributed to the heat load. Consequently, over the past few years, many textile mills have found it advisable to add refrigeration to their humidity control systems so that comfortable working conditions would also be created to assist in efficient production efforts."

Just this year there has been a noteworthy trend in the air conditioning of garment plants, again primarily for comfort. One outstanding example is an installation for Cluett, Peabody and Co., Inc. involving 794 tons of air conditioning for the comfort of 2300 employees in its "Arrow" shirt plant in East Point, Ga., and another for its plant at Bremen, Ga. These follow very successful production results in a smaller "Arrow" plant near Atlanta, which was air conditioned last year.

According to a recent estimate, over 2½ billion sq ft of manufacturing buildings have been constructed in this country since 1929. This in itself presents a potential air conditioning market amounting to considerably more than $10 billion at the retail level. And there is no doubt that a very substantial part of future industrial sales will involve plants still to be built and which must be designed for efficiency, he said.

Altogether, total retail sales of all types of equipment and installations by the air conditioning industry will surpass $4 billion in 1960, Mr. Wampler believes, a growth of over $3 billion during the decade. This compares "to estimated sales of $2 billion in 1954 and actual sales of $1¾ billion last year." Air conditioning will then be well on its way to the $5 billion annual level predicted by 1963.

pressure refrigerants were introduced in 1934 especially for air conditioning, and I believe they were largely responsible for the fast development of this market.

Congratulations, again. I hope the next 25 years finds both of us still doddering around telling them how it used to be in the good old days. — LESTER T. AVERY, President, Avery Engineering Co.

OWEN S. LIEBERG —

"Never Take Steam from HTHW Boiler"

SELDOM HAVE I read a more complete report on high temperature hot water than the article, *HTHW Serves Personal Products Plant 13 Years*, by Lewis Smith and Steven Senko, in the July HPAC. The authors are to be congratulated on their very clear, explanatory article. It gives engineers who are contemplating using high temperature hot water some good food for thought and to us, who have been recommending high temperature hot water because of its many advantages, it confirms the claims we have made for its greater use.

The following comments about the article are made from my many years experience in the design and operation of high temperature hot water systems.

No steam should be taken from a high temperature hot water boiler for soot blowing or any other requirement. It necessitates the addition of a feedwater treatment plant because the amount of steam required for soot blowing is no small item, particularly when the steam jets become enlarged with wear. To prevent this uneconomical loss, steam, if required, should be generated in a small heat exchanger. Unfortunately, the amount of steam taken for soot blowing is never metered. If it were, it would not be taken from the HTHW boiler direct.

The authors state that globe valves are now used instead of the originally installed gate valves, as . . . "these did not prove to be as satisfactory as globe valves". I hope that the authors will give us more details. Mr. Senko's experience is so valuable and selection of valves is so important that a further explanation would be very helpful. I was also interested in his experience with bronze valves and his change to stainless steel. It is these small but important points that make an article such as this so invaluable to the engineer. — OWEN S. LIEBERG, Mechanical Engineer.

K. E. ROBINSON —

"Base Ventilation Design on Fundamentals"

THE ARTICLE in the May HPAC, *Industrial Hygiene Comes of Age in the Last 25 Years*, by Herbert T. Walworth, was most interesting to me. I feel that Mr. Walworth has presented an excellent review of the growth and development of the field of industrial hygiene.

I believe that an addition should have been made to the statement in the article about the success that has resulted in industrial process ventilation being almost entirely due to the efforts of the industrial hygienist. It might be well to add that successful ventilation is almost entirely due to the efforts of the industrial hygienist or to the value of the material being handled. I feel that the industry has done exceptionally well in controlling the loss of valuable material.

As a ventilation engineer first, and an industrial hygienist second, I object to the statement in the article, "The industrial hygienist found through experience that the proof of a good ventilating system is not necessarily the good air flow contour of a hood, but rather the effect the resulting plant atmosphere has on the exposed worker. By basing ventilation design on this principle, it has been possible to economically control many of industry's health hazards."

Ventilation design must be based on the basic fundamentals of air flow if control is to be expected, and I am sure that Mr. Walworth will agree on this. Only by knowing the air flow contour of a hood can one design for proper ventilation. However, it is, of course, true that one tempers his design by the effect of the plant atmosphere on the exposed worker.

Mr. Walworth states this point very well in a later sentence, "Certainly, the design requirements should not be the same for a beryllium dust hazard as for a lead dust hazard where the equipment involved may be entirely different." It is by the change in the volume of air flow that the different degrees of control are obtained. I agree that less control is needed with non-toxic materials than with toxic ones unless there is such a high nuisance value that again good control must be maintained.

In connection with Mr. Walworth's comparison of dusts, I wonder how many engineers reading this article will know that the toxicity of beryllium far exceeds that of lead? I think that the comparison would probably have been more understandable if lead dust and cast iron dust were referred to in the article. — K. E. ROBINSON, Ventilation Engineer, Industrial Hygiene Dept., Research Laboratories Div., General Motors Corp.

MARCUS R. DURLACH, JR. —

"Multiple Boiler Article of Special Interest"

I WAS very interested in the short article concerning a multiple boiler installation in a school that was published in the December 1953 HPAC. I have clipped and filed this.

We have been utilizing this type of boiler, both in multiple boiler and in multiple boiler room installations, for many of the school jobs of our state. Our office is normally conservative in its design work and the fact that we turned to a slightly unorthodox type of installation for certain jobs is indicative of changing trends in architecture and in mechanical costs. For a while we ran into some problems with this type of installation and were considering returning to a more conventional design, but our original reasoning being sound and some of the mechanical problems having been solved, we continue to use the method for those jobs where it is best suited.—MARCUS R. DURLACH, JR., Consultant Mechanical Engineer.

"OVER 10,000 Satisfied Maryland Home Owners Attest to the Outstanding Qualities of REVERE COPPER WATER TUBE—"

Says, Anthony W. Keene, President, ANTHONY W. KEENE, INC., Heating & Plumbing Contractors, Baltimore, Md.

"I've been operating in the Baltimore area for over eighteen years," said Mr. Keene. "Typical of the 10,000 units in which I have installed Revere Copper Water Tube is the Meadow Lane development which you see on the wall of my office. I have worked with various builders and they have told me they wouldn't specify anything but enduring copper water tube for plumbing lines . . . no rustable materials for them. Not only that; copper is easy to bend, needs no threaded fittings so naturally we can hold down our installation costs. Ever since I have been in business I have used Revere Copper Water Tube and have never regretted one foot of it."

Keep out of trouble with copper . . . guard *your* reputation for quality work. Use enduring Revere Copper Water Tube. There's a Revere Distributor near you who carries a full stock in both hard and soft tempers. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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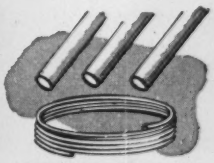
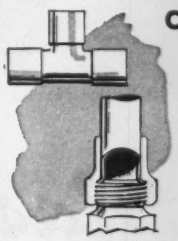
Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.





SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal

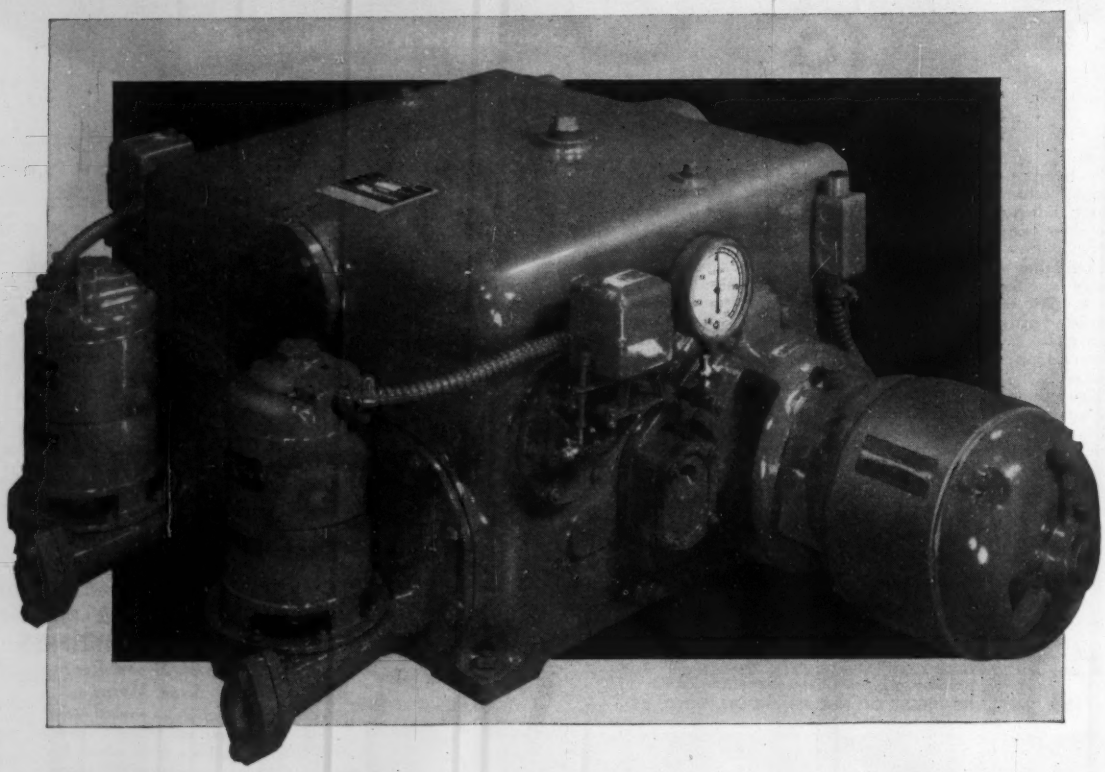
No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

THIS NEW VACUUM HEATING PUMP

HAS THE INCREASED AIR CAPACITY EFFICIENT HEATING PRACTICE DEMANDS



It's the Nash CSM

Designed and manufactured by the organization that made the Jennings Manifold Heating Pump standard of the Heating Industry, the new CSM incorporates every desirable feature architects, engineers, owners and operators have sought. Employing separate air and water pump elements, each with its own motor and each independently controlled by its own automatic switch, the capacities and arrangement may be widely varied to meet job conditions. For the first time, the engineer has the choice of realistic water and air capacities required for rapid system response without wasteful overheating.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

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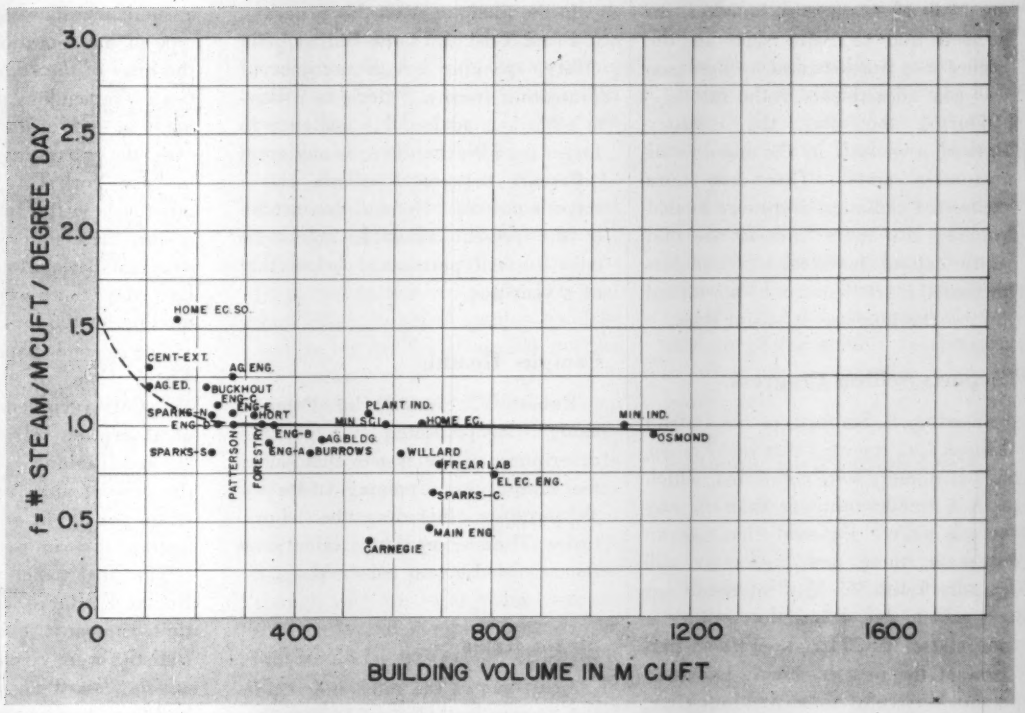


STEAM CONSUMPTION figures for Pennsylvania State campus buildings were given at the meeting. Here are yearly average factors for classroom buildings.

District Heating Develops

Reports at NDHA's annual meeting discuss increased sales, metering, reducing distribution costs. Great increase in air conditioning load is described.

By John F. Collins, Jr.

Secretary-Treasurer, National District Heating Association

MANY PHASES of district heating were presented and discussed at the annual four day meeting of the National District Heating Association, held this year at the Greenbrier Hotel at White Sulphur Springs, W. Va. Thirty-one technical reports and papers were presented at the six technical sessions, and answers to special problems were given at the seven breakfast meetings.

One of the most interesting of the NDHA's annual compilations is that of the operating statistics committee. This year, Foster L. Stephens, Allegheny County Steam Heating Co., Pittsburgh, chairman, summarized the reports turned in by 55 of the larger steam heating utilities from coast to coast. He reported that the total steam sold in 1953 was less than that in 1952, which was expected because there were less degree days in 1953. The average revenue

per M lb of steam sold, however, increased due to more sales in the higher rate brackets and to increased fuel cost adjustments in the rates.

During the year, the industry showed a growth in the number of customers served. There was more connected radiation and more heated volume, also more lines in use and more capital invested. Steam loss increased more than can be accounted for by the increase in steam lines.

Reports Selling Progress

Sterling S. Sanford, of the Detroit Edison Co., reported that in 39 cities, 529 customers were connected, which was a smaller number than in any recent year. He said that, as an estimate, these new customers will require 1,405,765 M lb of steam per yr, which will bring the utilities a revenue of $1,771,264. Fifteen percent of the new customers had used steam service at some previous time, 68 percent are in old buildings not previously supplied, and 17 percent are in new buildings.

One hundred and twelve customers were lost in 16 cities. Over half were in one city where the losses were the result of competition.

Boiler capacity is inadequate to serve new customers in nine cities. Only a limited number can be supplied in five other cities. Elsewhere, generating capacity is adequate. The total increase in boiler capacity in 1953 was 825,000 lb per hr — a figure greater than in any recent year. The entire addition took place in six cities. The total increase in 1954 will be 330,000 lb per hr and will occur in three plants.

In five cities, lack of distribution facilities now prohibits the addition of new customers. In one of these, construction will relieve the situation in 1954. Limited spare distribution capacity is available in 10 cities. In the other 37 localities, the systems are adequate.

The sales session then was addressed by Henry T. Kucera, president of Automatic Devices, Inc., on the advantages to the steam utility and to the customer of having adequate temperature control.

In the final paper on this program, J. Frank Gaskill, of the Philadelphia utility, speaking on the subject of Transition from a Seller's to a Buyer's Market, advised his audience to forget the idea that there is any great difference between a seller's and a buyer's market. He said that actually the present available market is only a small percentage below that of a year ago.

Campus Heating

Robert Y. Sigworth of Pennsylvania State presented in a paper a description of the system that serves the campus by supplying steam for all purposes, including the laboratories. The accompanying table gives the recorded steam consumption.

Steam Rates

Chairman of the rates and regulations committee, Clifford O. Thurlow, rate engineer, Commonwealth Services, Inc., Jackson, Mich., reported that the customary steam rate survey had been made as of February 1. Of the 98 communities for which rate information was obtained, in only eight had increases been made in their basic rate schedules and there were no decreases.

Fuel cost adjustments varied little in the year since the previous survey. A simple average of the unit charges applicable in these communities was 28.27c per M lb in 1953 and 25.3c in 1954.

Air Conditioning Load Grows

In introducing the program of the air conditioning committee, chairman Robert D. Martin, general manager of steam service operations of the Consolidated Edison Co. of New York, Inc. — parent of the former New York Steam Corp. — presented a summary showing the extent and type of air conditioning facilities on the lines of the country's steam utilities. Tremendous progress has been made in each of the last several years over the preceding year, especially in New York City, as described in my article in the June HPAC. From a start there in 1930, by 1948 there were installations totaling 10,500 tons. Last May, there were 97 installations totaling 53,408 tons.

The second paper was given by Victor Cole, of the Carrier Corp. Mr. Cole reviewed the development of absorption refrigeration units for air conditioning. He reported that the present units use about 19 lb of steam per ton-hr and are designed to operate at steam pressures of 12 psig.

The final paper was presented by Robert E. Burke, of Chairman Martin's company, and in it pertinent statistics were given for 12 representative residential and commercial buildings having year 'round heating and cooling systems actuated by either turbo-compressors or absorption units. Included in the figures were hours of operation, total ton-hr, steam use per ton-hr, peak steam demand and peak refrigeration demand. The average total annual operating hours for eight office buildings was 1527, which was higher than was anticipated. The full load operating hours averaged 823.

Valuable Addition

The air conditioning load is a valuable addition to the business of the steam utilities. The combined annual load factor of the seven buildings where peak hourly steam demands were available increased from 20.8 percent exclusive of refrigeration, to 33.5 percent with cooling. Steam for cooling may be considered as 61 percent and for heating as 39 percent of the variable monthly load.

STEAM CONSUMPTION in the buildings on the campus of Pennsylvania State

Type and number of buildings	Steam consumption, lb per cu ft per degree day		
	Maximum	Minimum	Average
15 buildings supplying housing but no food service	2.80	1.15	1.25
12 buildings supplying both housing and food service	2.30	1.30	1.40
28 class room buildings	1.55	0.40	1.00
Greenhouses, some with high and some with low temperatures	6.00	2.75	—

Commercial Relations

William P. Chapman, National Tube Div. of U. S. Steel Corp., opened the program of the commercial relations committee with a talk on radiant heating. Mr. Chapman said that the design of such systems is fast and accurate because there are now publications available which simplify the calculations. However, installation practices must be sound and universally acceptable.

In the final paper on the commercial relations program, a new water heater with an internal compensator was described and compared in operation with storage and instantaneous heaters as to safety, steam surges, water temperature control, scale formation and initial and operating cost, by Henry W. Angelery, president of Aerco Corp.

New Safety Committee Reports

The new safety committee, headed by Peter Barry, of the Rochester (N.Y.) Gas and Electric Corp. reported that the NDHA executive board had approved the affiliation of the association with the National Safety Council. It is planned to inaugurate annual safety contests between the steam utilities with an award to be presented to the company with the best record.

Metering a Problem

Four papers resulted from the year's activities of the metering committee, headed by William G. Gillim, of the Consolidated Edison Co. of New York, Inc.

In the first of these, John R. Heath of the Cleveland Electric Illuminating Co. described in detail the equipment and procedures at their new condensate meter testing and repair shop where meters for 650 low pressure steam customers are serviced. Mr. Heath said that with a few exceptions meters are changed every 24 months at the rate of about 50 per month.

An overhead tram rail system and a special hoist are used in the shop to move the meters. Two cylindrical tanks each with a capacity of 500 lb are mounted on two elevated scales and are equipped with thermometers and hot water, cold water and steam connections for testing. Tests are made with water at 140 F.

In the second paper, Robert L. Fitzgerald, vice president and general manager of the Duluth Steam Corp., made a progress report on his activity in connection with his proposal that a lightweight aluminum condensate meter be designed and put on the market.

Robert H. Brown of the Rochester (N.Y.) Gas and Electric Corp. declared in his paper that all efforts should be made to keep steam losses to a minimum until such time that a more satisfactory steam meter is available. He pointed out that even though such an ideal meter were on the market, a complete changeover still would be very costly. Mr. Brown then enumerated the steps taken in Rochester to decrease losses with the present type of meters.

In the last of the metering papers, Robert C. Wilson of the Ohio Edison Co., Akron, and Jay P. AuWerter, president of the C. E. Squires Co., described the use of the dual shunt flow meters in Akron and the additional experiments of a similar nature in New York City.

Generating Steam

Three papers were presented on the program of the steam station engineering committee, of which Walter M. Gillespie of Dayton is chairman.

David O. Foltz, of the Detroit Edison Co., described the replacement of 28 year old stokers in their Beacon heating plant with new ones. This change, plus the addition of front waterwalls, increased the capacity of each boiler by 50,000 lb per hr, but a number of additional steps had to be taken to provide proper fuel distribution.

Henry R. Fulton, of the Bailey Meter Co., suggested the extent to which steam utilities can go with various sizes of boilers in installing meters to reduce fuel cost, reduce smoke and dust, lower maintenance and outages, utilize operating personnel efficiently and insure safety and reliability.

In the third and final paper on the program, George M. Johnson, Rochester, N.Y., described the new equipment at station 9 of the Rochester Gas and Electric Corp.

Since operating conditions in district heating steam plants are different from those in the electric industry, operators in the heating plants are not able to take advantage of many modern power station developments to offset higher operating costs and poorer fuel.

Reducing Distribution Costs

The principal interest of the distribution committee during the past two years under chairman Vernon J. Suche, of the Union Electric Co. of Missouri, in St. Louis, has been to learn how to build better steam lines for less money.

John L. McKinley of the Public Service Co. of Colorado reported on the use of several materials not usually associated with buried steam lines. The experiences of several utilities using a new type of pipe protection and insulation were related. It appears that for proper results the type of protection used must be carefully selected with regard to the steam temperature and it must be properly tamped in place. One company reported that only by the saving resulting from its use were they able to justify the extension of a temporary steam line.

In one city, the use of a laminated fiber duct, which is manufactured in 18 ft lengths and with inside diameters from 2 in. to 24 in., was disclosed as quite satisfactory as an inside form for a buried poured concrete conduit. Because of its light weight, however, it must be held in place until the concrete is partially set.

In another city, the successful pouring of a refractory cement into a tile conduit which was about to collapse around a steam main was reported. Low temperature Portland cements when poured wet against the steam line did not form a suitable aggregate. Elsewhere, an investiga-

tion was reported of a new type of shop fabricated pipe insulation consisting of concentric layers of sheet aluminum alloy, separated ½ in. and supported by braided glass spacers for indoor use and for outdoor application with clay tile conduit. Installations using other insulations were also reported which have been found to be suitable for mechanical construction and which would save labor.

Eight Ways to Cut Costs

Homer F. Hatfield and John F. West, Jr., both of the Pennsylvania Power & Light Co., assembled information from 13 steam utilities on steam main design and construction methods. They have resolved this information into eight general types of conduit construction and have compared them as to cost without regard to points of superiority.

The authors reported that their correspondents indicated that expense could be saved by:

1) Locating obstructions exactly to permit the use of power equipment.

2) Closer engineering supervision.

3) The maximum use of basic materials and the welding of joints to lengthen life.

4) The use of prefabricated pipe and precast manholes.

5) Installing lines under sidewalks.

6) Limiting excavation to the minimum.

7) Handling pipe mechanically as much as possible.

8) Welding long sections of pipe at street level.

Ernest T. Smith, of the Detroit Edison Co., has investigated prevailing practices regarding the design, location, operation and maintenance of service valves, and he reported that the replies to his questionnaire showed there is no uniformity of thought. Regardless of the steam pressure, some steam companies put the valves in the street while others place them inside the customers' buildings. Some install them in both locations. Some steam utilities place the valves in manholes, but others use only valve boxes. However, the steam supplier usually pays for the extension.

On the same program, Walter A. Schulmeister of S. E. Dockstader, Inc., showed a movie of the installation of a steam feeder line insulated with cell concrete.

In the closing presentation, David C. Goff, manager of the Z-crete Div. of the Zonolite Co., described his organization's research program, then introduced Dr. George Ziegler, their director of research, who described the theory of heat flow from an underground steam conduit.

Study Steam Losses

The chairman of the steam losses committee, Robert C. Wilson, Ohio Edison Co. in Akron, outlined the phases of the steam loss problem that have prevented accurate quantative analyses of these losses. He proposed a four year study by subcommittees to bring light on this difficult problem.

In his presidential address, Charles W. Deeg outlined the progress that has been made during the past year and predicted a bright future for the industry, mentioning summer air conditioning, the desire for cleaner atmosphere, the labor situation and the difficulty of fuel delivery in congested areas as favorable factors. Details about the operation of the association were added by Secretary-Treasurer John F. Collins, Jr.

Membership chairman Frank B. Mahon reported a new high in membership of 600 for the association.

Leo F. Collins Elected

The new president of the NDHA is Leo F. Collins, of the Detroit Edison Co. and a member of HPAC's board of consulting and contributing editors. The late Thomas P. Brown, Jr. of the Consolidated Edison Co. of New York, Inc., first vice president of the NDHA before his recent death, was unable to accept the nomination for president because of his health.

The late Mr. Brown was elected first vice president, Vernon J. Suche of St. Louis, second vice president; and Walter M. Gillespie of Dayton, third vice president. The four vacancies on the board of directors were filled by the election of William G. Gillim, of New York, George F. Prestwich, of Philadelphia, Arthur H. Sy, of North Tonawanda, N.Y. and James C. Thompson, of Atlanta.

Bank Building Modernized With Air Conditioning

. . . upper 22 floors

AIR CONDITIONING of the upper 22 floors of the 40 yr old, 26 story First National Bank building in the heart of the Pittsburgh business triangle is announced by the Carrier Corp. The four lower floors were already air conditioned. The air conditioning system will supply heating this winter and be ready for year 'round conditioning early in 1955. The system is being installed during regular working hours with a minimum of interruption.

Individual controls will permit the occupants to select their own temperature. Chilled water for the air conditioning system and for the air handling units serving interior zones will be provided by a 500 ton centrifugal compressor in the sub-basement. Two large conditioning units, one on the third floor and the other on the 26th floor, will deliver 40,000 cfm of air to interior zones of the 22 floors to be conditioned. Another 100,000 cfm will be distributed through the individual room units. A cooling tower on the roof will permit recirculation of condenser water, reducing consumption to about 5 percent of what would otherwise be required.

The Peter F. Loftus Corp. of Pittsburgh is acting as architect and consulting engineer. Martin & Nettrour Contracting Co. is performing the general contract work, and McGinnis, Smith & McGinnis Co. is the piping contractor.

Designing the Test Room

. . . air conditioning system

By F. F. Stevenson

• This article is the third of a group which describes the details and factors that a design engineer must consider in laying out and installing air conditioning systems for product testing laboratories. The first appeared in the March HPAC and the second in June. This month, a complete description of control systems is given along with the problems encountered. Actual installations and experiences are referred to — and what had to be done to correct some problems that developed in the operation of the systems. These articles are based upon the author's personal experiences in designing such installations.

AS MENTIONED in my first article, it is often desirable to design and build up the air conditioning units from individual components for the particular function and requirement that is desired to serve the product testing laboratory, to provide the essential flexibility in such an application. The general considerations in designing such a system were discussed in the March article and in June, specific installations were described with some of the problems that were encountered and solved when the system started to operate. This month, a description of control systems is given.

Mr. Stevenson has contributed many articles to HPAC for over 15 years. He is a design engineer, who has had wide experience in heating, ventilating and air conditioning. He has been engaged in contracting work and also with several engineering and architectural offices.

The system should be provided with properly sized fans, cooling coils, defroster and filters. Also, the system should have a heater and humidifier.

Moisture Removal a Problem

The removal of moisture during and after the defrost cycle proved to be the real problem on one installation with which I was concerned. To begin with, the drain pan and drain outlet provided with the air conditioning unit was not adequate for the amount of water dripping off the 10 row coil. The pan was not pitched properly to the drain outlet, and water backed up in the pan instead of draining off freely. Water finally seeped into the insulation and ruined it.

Control System Outlined

The automatic control system was pneumatic, because the main controls in the plant used air, and it seemed desirable to follow the same pattern for the test room controls.

For the cool dry cycle, a space thermostat and humidistat were provided. The duty of the thermostat was to make or break the electric circuit to the heater and to activate the voltage regulator by modulation. It was a sensitive instrument with a differential of less than 1 F. As the purpose of the cooling coil was to dehumidify the air, with cooling as a byproduct, the refrigerant solenoid feed valve was actuated by the humidistat, through an electric-pneumatic switch, as shown in Figs. 1 and 2.

The same controls were also used for the hot wet cycle, with a master control and a selector switch affording a remotely controlled switchover. To make the test room system independent of plant compressed air, a separate motor driven air compressor and storage tank were installed.

On the cool dry cycle, the humidistat was not connected to the compressor motor starter — only to the feed valve. The machine was started and stopped by the low side switch with the cut out point set low for pumpdown control. The control was designed so that the cut out point for the compressor could be synchronized after the system had been operating for awhile — by a trial and error check with the defrost control — so that it would run continuously, except during the defrosting period.

During the initial operation of the compressor, the humidistat was connected to the cylinder capacity control. As the humidistat tended to become satisfied, it acted to raise the suction pressure at which the compressor would run with one or more cylinders unloaded. For instance, if the normal operation of the capacity control were to start unloading at zero lb suction, then with compensated air control, the compressor would start to unload at, say, 5 lb. This, of course, tended to raise the operating suction pressure as the load fell off and to keep the machine running at low capacity. The air compensated capacity control did not work too well, however, so it was abandoned and the capacity controller permitted operations from variations in suction pressure.

The use of an air compensated compressor control has an advantage only when the load fluctuates widely.

It probably should be mentioned here that the system of refrigeration

Glossary and Operating Notes

Dampers and damper motors

D-1, Damper Motor, Outside Air
D-2, Damper Motor, Return Air
D-3, Damper Motor, Defrosting Cycle
D-4, Damper Motor, Heater Voltage Regulator.

Damper motors to be of the piston type, normally open or closed, as required.

Damper D-4 should have its shaft connected to the control arm or lever of the voltage regulator. The control circuit should be arranged so that when the blower stops, the outside air damper and the damper in defrosting exhaust duct shall be closed and the return air damper be open. As most laboratory testing systems operate with 100 percent return air or with a mixture of return air and a small percentage of outside air, the operating setting of D-1 and D-2 shall be arranged accordingly. D-1 should never be wide open except for defrosting and D-2 should never be tightly closed, except for defrosting. The defrosting timer control shall actuate D-1, D-2 and D-3 automatically. The defrosting timer should be switched out of the control circuit during the hot wet cycle. The normal operating setting of D-1 and D-2 may be made manually by means of an air switch.

Thermostats and Defrosting Timer

T-1, Submaster insertion thermostat, reset by H-1 and controlling V-1
T-2, Space thermostat, controlling D-4, which in turn operates the heater voltage regulator.

Humidistat

H-1, Humidistat to reset T-1 and to control V-2
DT-1, Defrosting Timer, controlling defrost heater and D-1, D-2 and D-3.

Notes: The control of refrigerant to the cooling and dehumidifying coils is by T-1, which in turn is reset through a narrow temperature range by H-1, which reflects the dehumidification load. It is not necessary to govern the work of the cooling coil by a space thermostat because the work of dehumidification necessitates reducing the temperature of the supply air to a level, which is perhaps 40 F lower than the temperature at which it can be introduced into the room.

Control Operation

T-1 is a pneumatic controller and is hooked up to the electric solenoid valve V-1 through a pneumatic-electric switch. Using the discharge thermostat T-1, a quick and positive control of refrigerant liquid to the coil is provided. The upper range of T-1 is that for a minimum room latent load and the lower range is for a maximum latent load.

T-2 controls the electric heater for both the cold and hot cycles, operating through D-4 and the voltage regulator. Its temperature range must be changed for each climatic cycle. It is connected to the electric circuit through a pneumatic-electric switch and to D-4 through an air line. H-1, in addition to resetting T-1, also controls the steam valve V-2 in a modulating manner, during the hot wet cycle. Its range shall also be changed in accordance with the climatic cycle. DT-1 is an electric timing device making or breaking an electric circuit to the switch of the defrost heater and controlling the pneumatic damper motors through electro-pneumatic switches. The defrosting control shall be arranged so that after the defrost heater is disconnected, the defrost dampers shall not be actuated for several minutes. This is to allow time for all moist air to be evacuated.

As most operators of testing rooms wish to record temperature and humidities, the controls should be of the recording type. It is suggested that the charts do not cover a longer period than 24 hours. It is also well to check the calibration frequently.

Valves

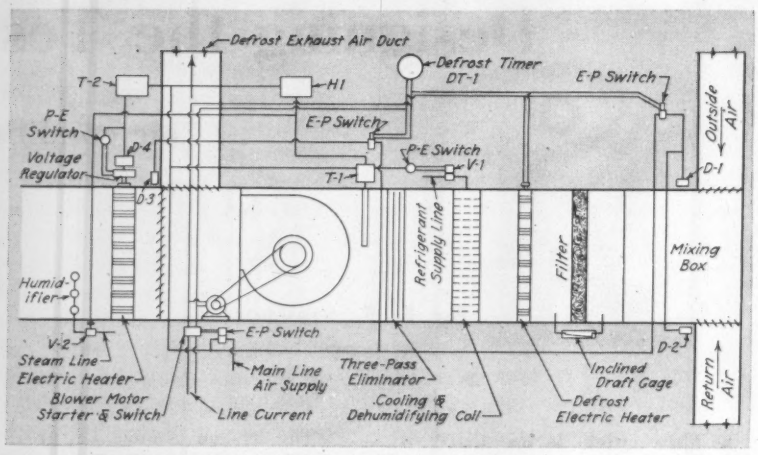
Valve V-1, an electric solenoid valve, regulates the flow of refrigerant to the coil. This is a normally closed valve with internal pilot operation. V-2, a Pneumatic modulating steam valve, regulating steam flow to the grid humidifier. It is a normally closed valve. The blower of the unit should be controlled by a manual electric switch. The electric circuit of the blower motor starter is interlocked with the pneumatic circuit through an electro-pneumatic switch, so that when the blower is stopped, V-1 and V-2 are made inoperative. The defrost heater and the duct heater are interlocked electrically with the motor starter and are made inoperative when motor stops. The interlocking of the dampers has been already described.

Refrigeration Machine Control

The compressor should be equipped with capacity controllers, which act to bypass the gas flow back to the suction intake so that a predetermined suction pressure is maintained, regardless of fluctuations of the load. Capacity control should be at least 66 2/3 percent of the capacity of the cylinders. T-1 to control V-1 only, it shall have no connection with the compressor motor. The compressor motor should be started and stopped by a low side switch. The compressor motor and blower motor should be interlocked electrically, so the compressor cannot be started if the fan is off. Also, the compressor motor without the blower, and the compressor motor starter should be interlocked with T-1 and H-1, so that low side switch cannot start the compressor motor except when T-1 and H-1 are set at their low range — cold dry cycle. The cut out point should be set for a low pressure to make the running cycle as long as possible and the off cycle very short. It is contemplated that during normal operation, the compressor, with its capacity control functioning, will operate almost constantly, except during the defrosting periods. The control circuit should be so interlocked that V-1 cannot be opened during the defrosting period and T-2 cannot complete the electric circuit to the duct heater. Also, the low side switch cannot start the compressor motor unless V-1 is open.

Change-Over Period

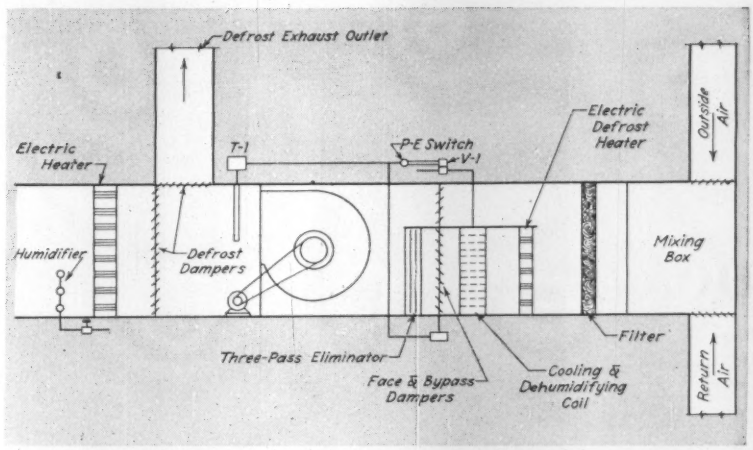
During the changeover period from the hot wet operation to the cold dry operation, it may be desirable to dry out the testing room quickly. This may be done by the use of a second fan or exhauster and bringing in 100 percent outside air through the unit and supplying it to the room. During the winter, it will be necessary to heat the supply air and the defrost heater may be used for this purpose. The capacity of the defrost heater must therefore be checked against such a load. The supply air, after having absorbed moisture from the wet room, must be exhausted. A small exhaust fan may be used or a roof ventilator, power or gravity. A supplementary control system must be provided for this work. A control switch makes the electric circuit to the defrost heater, starts the exhaust fan for ventilator and opens the exhaust vents. Also, the controls must position D-1 and D-2 properly.



1 THE PNEUMATIC CONTROL diagram for the test room air conditioning system is shown here. This does not show air relays, valves, cumulators or similar devices

and humidity control just outlined does not give the precise modulation required in such an installation. It is practically impossible to provide such a control with a direct expansion coil fed by a thermal expansion valve, even with no consideration of cost for additional equipment. Later, improvement was made in the control system by installing a submaster thermostat on the downstream side of the cooling coil, which was reset by the humidistat, installed as the master control. The submaster thermostat actuated the solenoid feed valve. This afforded a direct temperature control of the air being delivered from the cooling coil and provided quicker response to the needs of the system. If a similar installation were to be designed again, and if it were larger so that bigger equipment and higher air flow rates could be used, a method could be used that would bypass a part of the air around the coil during the normal cycle — after pull down. With this design, the air through the coil would be reduced to a lower dew point temperature, so that a mixture of treated and bypassed air would be able to handle the latent load. In this case, the mixing dampers would be manually operated and set permanently, except during the pulldown cycle.

The same submaster discharge control which would actuate the feed valve would be employed, reset by the humidistat, acting as a master control. With this method, pump-down control of the compressor could be used. Such an arrangement would require considerably more space and be more costly, but it would provide more uniform control, and it would also help some of the defrosting problems as the bypass might be used during the defrost cycle.



2 THIS SUPPLEMENTARY pneumatic control diagram shows a method for bypassing air around the cooling and dehumidifying coil

Alternate Plenum Design

Fig. 2 is supplementary to Fig. 1. It incorporates an air bypass around the cooling and dehumidifying coil. Thermostat T-1, which is reset by the humidistat H-1, controls both the refrigerant solenoid valve V-1 and the damper motor D-5. T-1 should be a direct acting control, exhausting air from its branch line on a rise in temperature. V-1 should be a normally closed valve, requiring the energizing of its solenoid to open. Therefore, the P-E switch should be a type that makes the electric circuit on a drop in air pressure. D-5 should be a type which opens the face damper and closes the bypass damper on a drop in air pressure and vice versa on a rise in air pressure.

Assuming air pressure to be available up to 15 or 16 psig, then the operating sequence may be as follows: On a continued call for cooling, T-1 shall exhaust air from the line to D-4 and the face damper shall be wide open. T-1 shall also exhaust air from the line to the P-E switch, making the electric circuit and keeping the valve V-1 open. As the cooling load diminishes, T-1 shall start to deliver air to both branch lines. As air pressure, reaches say 4 psig, D-4 shall start to close the fan damper in a modulating manner. Range of D-4 is suggested to be 8 psig, so that when T-1 puts 12 psig pressure in its branch lines, D-4 shall act to close the face damper tightly. The differential of the P-E switch is set to break the circuit to V-1 at 12½ psig and make the circuit at 11½ psig. Thus, the solenoid valve will be closed directly after the face damper has been closed and will be open directly after the fan damper starts to open. The P-E switch should be one that can operate on a very low air pressure differential. It is suggested that the system be arranged so that some supply air is always by-passed, even at peak load. Therefore the minimum setting of the bypass damper is never tightly closed. This means that the temperature of the discharge air leaving the coil will be at a point so that the mixture of fan and bypass air will be suitable for the load requirements. It then follows that the air leaving the coil will always be at a lower temperature and humidity than the mixture which will make for an almost constant running cycle of the compressor. This is highly desirable. The face and bypass damper control should be interlocked with the defrosting timer, so that the bypass damper shall be closed tightly during the defrosting period.

Mixing Box

Size and shape to be left to the judgment of designer and/or requirements of duct connections and available space. If a ready made unit is used, the mixing box can be furnished by the manufacturer. Outside and return air ducts to be installed as per requirements of installation.

Mixing Dampers

Must be tight closing. These may be arranged so that one damper motor can operate linkage for both dampers. Setting for the required amounts of outside and return air may be done manually. Change of damper setting during defrosting period is done automatically as described in the article. After the defrost period, dampers should go back to the normal setting.

Filters

Filters may be of the cleanable, renewable or throwaway type. They may be arranged straight up and down or in a V. If the filters are expected to remove much dirt, soot or lint particles, an inclined draft gage, connected with total pressure and static pressure Pitot tubes, may be placed across the filter to indicate pressure drop, which will serve as a signal for filter cleaning or changing. Arrange to locate the gage where it will be readily visible.

Electric Heaters

Provide a gasketed cover plate in the side of the casing for the installation of the heaters. Strip heaters should be furnished with a mounting flange and gasket and a terminal connection cover. The conduit outlet connection should be in side of casing. As a safety precaution, the electrical circuit to the control switch should be so arranged that the circuit shall be broken in the event of blower failure.

Cooling and Dehumidifying Coil

Fins should have wide spacing. Drip pan should be sized and sloped for easy drainage. Without the eliminator, the drip pan should extend downstream from the coil a distance of at least 0.5 times the height of the coil. With an eliminator, the distance may be shorter. The eliminator should be three-pass, and its resistance should be calculated. If coil is two sections high, a separate drip pan should be installed under the top section. The thermal expansion valve should be located outside of the casing and its thermal element should be cross charged with a liquid suitable for low temperatures. The solenoid liquid line valve should be normally closed and internally pilot operated.

Blower

Blower should be V-belt driven and an adjustable pitch motor sheave is a great convenience. Blower should have ball bearings. Lubrication should be of a type that will give service down to −20 F, but bear in mind that fan will also operate at 100 F. Motor may be of the variable or two speed type, if required.

Defrosting Dampers

These dampers must be tight closing, with the interlocking edges carefully lined. They will have to be relined at periodic intervals, as it is difficult to find a lining materal that will stand up very long under the cold dry and hot wet conditions encountered in these applications.

Humidifier

Steam grid type, of perforated piping. Locate the drip pan below the humidifier. The end of steam line should have a drain valve. The steam valve should be of the modulating type, normally closed. The control circuit should close the valve in the event of blower failure.

Eliminator

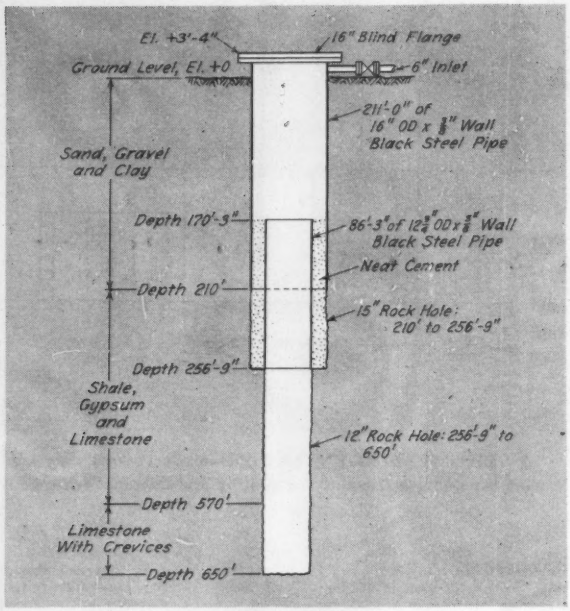
Locating the moisture eliminator in a dual cycle operation of the type described herein is a problem. Placing it ahead of the fan, as shown on the drawings, is satisfactory for the operation of both the dry and the wet cycles, but for the defrosting phase of the dry cycle such a location is far from ideal. In the first place, it conflicts with the design of exhausting all the saturated air — with its entrained water — to the outdoors. A considerable amount of water is trapped by the eliminator if the system is small and consists of a packaged type of air conditioning unit. However, there is always the danger of water seeping through the unit casing and ruining the insulation. Based upon experience, it seems that the eliminator would be better located on the discharge side of the fan, ahead of the heater and humidifier, but after the exhaust duct connection.

Defrosting Difficult

Defrosting was especially difficult when pulling the room down to design conditions, after it had been out of use or had been on the hot wet cycle. A period of 12 hr was allowed between the wet cycle and the dry one. When the wet cycle was completed, the room doors were opened and air was returned from the room through the return air intakes, sent through the unit and discharged to the atmosphere through the exhaust duct which was used in the defrost cycle. Makeup air was provided by opening the doors. When the room was in a reasonably dry condition, the controls were reset for the cool dry cycle. The load at this time was, of course, much higher than normal, but as a day was allowed for the pulldown, the return air duct was dampered down and only a small quantity of air was delivered through the unit. No outside air was used at this time. The coil, with its close fin spacing, frosted up quickly and did not defrost nearly as quickly as the manufacturer specified. Soon it was learned that the control of defrosting through a controller responsive to a deviation of pressure loss through the coil due to increased ice formation would not be satisfactory. Such a device tends to be affected by the loading of the filter ahead of it, but as very little outside air was used and that was clean and there was little dust or lint picked up in the room, the filter could not be held responsible. A conventional time clock control was substituted by which the time intervals could be manually set between the defrost periods, as could the duration of the period. This arrangement worked very well.

Plastic Pipe Lines Well

. . . to handle corrosive waste water



1 CORROSIVE PROBLEM was solved by lining the casing of the disposal well with 270 ft of 6 in. plastic pipe

By E. S. Moreland
Vice President
Carlon Products Corp.

A SERIOUS CORROSIVE water disposal problem had to be solved after the new plant of the American Cyanamid Co. was constructed in 1951 two miles east of Michigan City, Ind. and one mile south of Lake Michigan. This problem was the disposal of waste water containing corrosive chemicals, at the rate of 300 gpm continuously, which if discharged into an open stream or lake would be very objectionable.

There was considerable discussion between the company engineers and the Indiana state conservation and health departments about the possibility of disposing of this waste water at the surface, but it was concluded that there was no satisfactory way of doing this. Geological records, however, indicated that there might be a chance of disposing of this waste water at a considerable depth in a disposal water well where the ground water is also of a bad quality. Such disposal at least would not make conditions underground any worse.

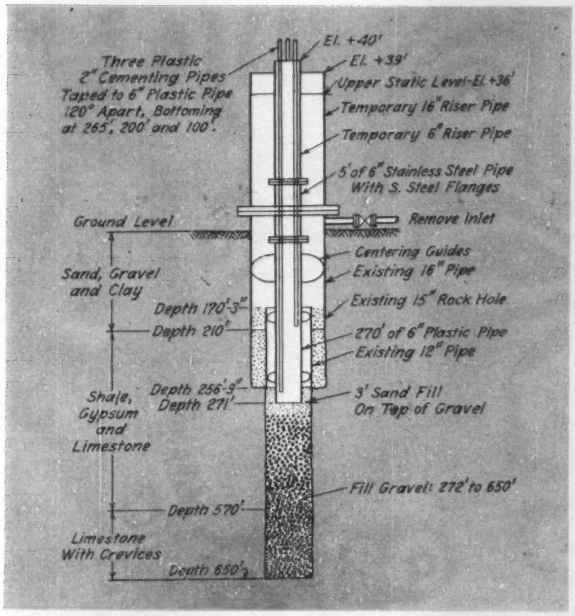
Disposal Well Drilled

A disposal well was drilled in 1951 to determine whether this plan could be successful. The construction of the first well, which encountered a considerable number of crevices in the limestone at a depth between 570 ft and 650 ft, is shown in Fig. 1. The natural ground water in this well was under pressure and a natural static head of about 20 ft above ground existed. Observing this flow gave an excellent opportunity for determining the probable ability of the rock formation to take the waste water when the flow would be reversed.

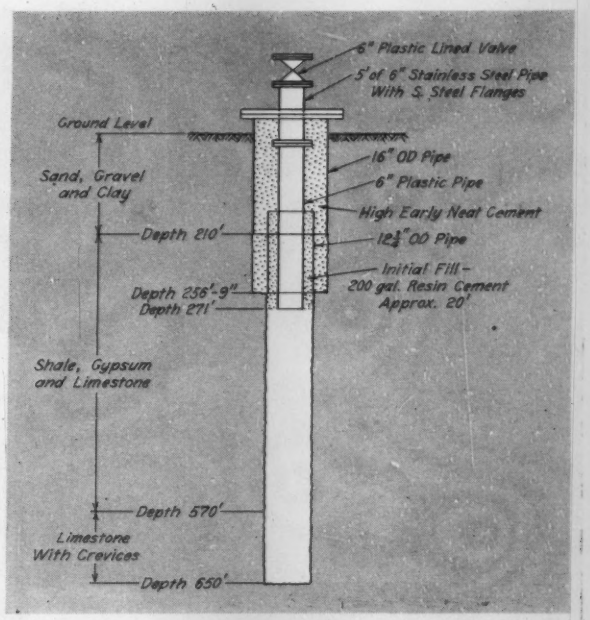
A low flow rate was encountered at a depth of about 250 ft, and this gradually increased until a depth of 570 ft was reached. After this, the flow increased rapidly, when at 650 ft the flow seemed to increase no more. At the 650 ft depth, the flow rate was approximately 470 gpm. The water flowing from the well contained a high precentage of chlorides and hydrogen sulfide and therefore was high in corrosiveness.

Pump Delivers 350 Gpm

In order to demonstrate the actual ability of this well to take water, a pump was installed and a test was conducted in which the water flow rate into the well and the pressure developed at ground level were measured. This test proved satisfactory and showed that up to 500 gpm could be pumped into the well with a head pressure of 57 ft at ground level. The pump had to operate against a head of 20 ft to overcome the natural head above ground plus an additional 37 ft in order to force the water into the underground formation. After the permanent pumping equipment was installed, it was possible to deliver 350 gpm continuously into this well with a head pressure of between 20 to 25 ft at ground level.


Three Plastic 2" Cementing Pipes Taped to 6" Plastic Pipe 120° Apart, Bottoming at 265', 200' and 100'.
El. +40'
El. +39'
Upper Static Level-El. +36'
Temporary 16" Riser Pipe
Temporary 6" Riser Pipe
5' of 6" Stainless Steel Pipe With S. Steel Flanges
Remove Inlet
Ground Level
Centering Guides
Existing 16" Pipe
Sand, Gravel and Clay
Existing 15" Rock Hole
Depth 170'-3"
Depth 210'
270' of 6" Plastic Pipe
Existing 12" Pipe
Depth 256'-9"
Depth 271'
3' Sand Fill On Top of Gravel
Shale, Gypsum and Limestone
Fill Gravel: 272' to 650'
Depth 570'
Limestone With Crevices
Depth 650'

2 THE PLASTIC PIPE liner was cemented to the casing by pumping resin cement through the three 2 in. plastic pipes taped to the outside of the 6 in. pipe



3 CEMENT WAS PUMPED to the three levels in three stages to avoid excessive pressure outside the plastic pipe in order to prevent a collapse

Line Well With Plastic Pipe

The problem of disposing of the water had been solved, but the next problem was to line the well so that the corrosive waste water and the corrosive natural ground water would not ruin the casing and destroy the well. Plans to meet this problem were then prepared by the Chemical Construction Corp., a subsidiary of the American Cyanamid Co., under the supervision of H. I. Wood, the water supply engineer. These plans called for the installation of 270 ft of 6 in. plastic pipe — made of an acrylonitrile resin rubber compound — cemented in place with resin cement at the bottom and with high early cement in the upper portion of the well around the plastic pipe.

Provision was made for 5 ft of stainless pipe at the surface which would be solidly cemented in place to avoid any strain and possible breakage of the plastic pipe. The contract was awarded to the Layne-Northern Co., Mishawaka, Ind., to make the installation. The initial preparation for the installation of the plastic pipe is shown in Fig. 2.

Liner Cemented to Casing

The well was filled with fine gravel to a depth of 271 ft below the surface and the existing 16 in. pipe was raised 43 ft above ground level to kill the flow in the well and provide a static water condition. This was done so that the cement would not be washed out during the plastic pipe installation. The 6 in. plastic pipe liner, 270 ft long, was lowered in place using centering guides and with three 2 in. plastic cementing pipes taped to the outside of the 6 in. pipe. These 2 in. pipes were spaced around the 6 in. pipe 120 deg apart and extended to depths of 265 ft, 200 ft and 100 ft, respectively. A temporary 6 in. steel pipe was installed 45 ft above ground to guide the plastic pipe.

After the plastic pipe was in position, 3 ft of sand fill was placed on top of the gravel outside of the plastic pipe to form a base for the cement. The cement was pumped around the 6 in. plastic pipe under pressure, and the first stage included 200 gallons of resin cement which contained properties similar to the plastic pipe in being able to withstand the extremely corrosive water. After this resin cement had made its initial set, the balance of the space between the 6 in. plastic pipe and the 16 in. well was filled with high early cement to the surface. This cement pumping job was done in three stages to avoid excessive liquid pressure outside the plastic pipe, which might have caused a collapse.

After the cementing operation had been finished, the gravel was pumped out of the bottom of the well by an air lift. Then the plastic lined 6 in. valve was placed on top of the 6 in. pipe and a test was conducted to determine the open flow rate, which was 685 gpm, or considerably more than the original flow of the well. The finished installation of the plastic liner in this well is shown in Fig. 3, ready for connection to the plant disposal pumps.

LOOKING AHEAD

Can Air Conditioning Be Simplified

. . . in large buildings?

The author proposes that the present method of removing heat from air be reduced from four steps to one — air to air. This would also reduce the number of conduit "networks" to three instead of from five to seven, simplifying the installation and reducing the maintenance and repair problems.

It is essential that the architects, structural engineers and mechanical engineers design and plan the building together from the beginning. The air conditioning system is no longer "a postage stamp to be stuck on later."

By J. W. Kreuttner, Vice President

Buensod-Stacey, Inc.

DEVELOPMENTS of the last 20 years have changed our conception of air conditioning from that of a semi-luxury to a fundamental necessity in the consideration of new buildings whether they be used for offices, public assembly, department stores, apartment houses, hospitals, hotels or other continually occupied space. Unfortunately, the techniques of air conditioning have not kept pace with this increasing demand. There are, for example, many things involved in the conditioning of large buildings besides the introduction of clean conditioned air and the evacuation of it after it is partially vitiated and contaminated.

This article has been based upon a talk given by Mr. Kreuttner at the third annual meeting of the Building Research Institute which was held recently at Hershey, Pa.

Air Conditioning Must Satisfy

There are such factors as space for central apparatus, space for cooling towers, loss of usable floor area

to care for networks of conduits carrying the conditioning fluid or fluids, intrusion of the air conditioning distribution system into the scheme of decoration and physical arrangement, cost of the original installation, cost of operation and maintenance and other considerations which vary with the particular requirements of the building. But principally the air conditioning system must satisfy the greatest number of individual ideas of comfort among the building's occupants.

Among the seven factors just enumerated, three relate to space and three relate to the direct cost of air conditioning. However, the three factors relating to space can affect the cost of the building much more than the direct cost of conditioning. For example, the entire mechanical equipment cost excluding elevators and electrical work will average less than 15 percent of the total building cost, but it is estimated that the overall cost for an air conditioned structure will be approximately 18 percent higher than a similar building with equal usable area without conditioning. This indicates that by far the largest item of cost in the conditioned building is the cost of the structure due to the additional height and floor area necessary to accommodate the air conditioning system.

Some efforts have been made to reduce the space used by air conditioning, but they have not been definitive and consist mainly of the use of "high pressure, high velocity" duct systems.

Three Factors Discussed

There are many indicated avenues of development, but because of limited space only three major factors will be discussed. These are the heat extraction and addition for determining the proper calorific value of the conditioning fluid, the distributing system of conditioning fluid or fluids, and the flexibility of operation and control of temperatures and humidities.

Our aim should be the development of an air conditioning system that occupies little space, has a low initial and operating cost, is simple to operate, has long life, few moving parts, and one which is so flexible that any individual can change the environment immediately around him to balance his simultaneous metabolic rate, his clothing, his neurotic reaction, the time of day and his changing moods.

All this sounds a little far-fetched, but it is surprising how often yesterday's fantasy becomes tomorrow's standard practice. We never realize all our objectives, but our history has been one of constant improvement and gradual elimination of awkward methods and poor efficiency.

Air conditioning, as has been pointed out, includes many factors besides the control of temperature and relative humidity, but it starts with the control of the heat content of the circulated air. Current practice is to extract heat from the air by a complex system of refrigeration and heat exchangers. First, we conduct outdoor air through a cooling tower to remove heat from water. This water is passed through a heat exchanger to extract heat from a refrigerant — usually a complex chemical compound which has characteristics that require its segregation from the rest of the building by means of many safety devices and special arrangements. The refrigerant then takes heat from a second circulating water system, and finally this water removes heat from the conditioned air used to produce comfort. Air to water to refrigerant to water to air. Silly, isn't it? Even sillier is the fact that at each point of exchange a new prime mover is added with its consequent additional power requirement. That is present practice.

One Step, Instead of Four

Our aim for this phase of the system should be outdoor air to extract heat from the conditioned air. One step, instead of four. This is perfectly possible in theory. Over 20 years ago, de Bothezat developed a possible method which was based on recovery of energy in sufficient amount to keep the power requirement within suitable limits. Even earlier, one of the steps had been eliminated by the use of water as a refrigerant. Both of these ideas have been shelved or forgotten. We start so many things and abandon them before all possibilities are explored.

The addition of heat to the air is generally supplied through a network of steam or water conduits distributed through the building to heat the conditioned air as required in local areas. This is a double network, supply and return, in addition to the two — supply and return or exhaust — networks of air conduits. Why do we need these two additional sets of conduits and why an additional conditioning fluid? Any fluid will convey heat, so why not use air? This would require a third network of air conduits, one cold supply, one warm supply, and one exhaust or return network.

A distinct advantage of the all-air system is that when a small leak develops in a water or steam line, immediate attention is required. A small leak in an air conduit causes little or no damage and may never require repair. After all, it is conditioned air leaking into the conditioned space, and it does not cause water damage to interior decoration or by accumulation, damage to the building structure.

Our generally used arrangement today includes two systems of air conduits, one for supply, the other for evacuation. A second pair of conduits supply and return a chilled fluid, usually water, to extract heat from circulated air as local areas demand; a third pair of conduits supplies and returns a second fluid to add heat to the circulated air as local requirements demand. The last two pairs of conduits are sometimes combined and arranged to carry warm or cold fluids alternately, depending on the general temperature outdoors. This reduces the webs through the building from six to four and, of course, is done to reduce cost, but such an arrangement is not entirely satisfactory. It involves additional heat exchangers, and while it is satisfactory in both hot and cold seasons, it has many drawbacks in the intermediate fall and spring periods. With this method, there is required an additional network, a system of drains to carry off condensed moisture from the local conditioned spaces. This makes a total of either five or seven building networks, either three or five of which are pipes carrying water or steam, subject to maintenance of specialties, corrosion problems, and requiring space otherwise usable.

Use One Fluid, Air?

A system using one fluid, air, which is essential in any system, and consisting of a maximum of three conduit networks, is a step forward in simplification and provides a reduction in maintenance and repair problems. To reduce space requirements, more study should be given to higher velocities, approaching those of steam in normal heating systems, refinement of current practice in the design of conduits, the elimination of as many as possible of the awkward steps now used, and the consequent elimination of expendable apparatus.

There is another network in the building which requires further analysis. I refer to the steel web of columns and beams which holds the structure together. This part will require early and complete cooperation between the architect, structural designer and mechanical engineer. It is not unusual to find a building with horizontal beams and vertical columns in which the actual area occupied by steel is only 10 percent or less of the total area of the beams or columns. For example, I recently checked some architectural and structural drawings of a large office building and found that a column 20 in. square or 400 sq in. of floor area had as its core a steel member with a total area of 22 sq in. As this occurred every 20 ft in both directions, proper utilization of the waste space would have provided more than adequate room for a complete system of air distributing and recirculating conduits. By proper study and a functional redesign of steel, a substantial reduction in overall cost — including more usable space — can be achieved. As long ago as 1930, a research building was designed and built with hollow steel columns used for supply and return air shafts. More recently, the same basic idea has been used, but never, in my opinion, as completely as it should have been.

Control System

The third phase of the general problem relates to flexibility and control of local atmospheric conditions. Our present method is to add still another web through the building. This one is either electric wiring or small compressed air piping for providing power to operate controllers which regulate the temperature and the relative humidity. This is the phase which directly affects the occupant for whom the entire system is installed. Again, there is a basic cost which permeates the entire structure, and there is an all pervading maintenance problem which increases with age. This arrangement interconnects all thermostatic stations which in the nature of things should not be inter-related at all. Each one should be capable of independent setting to satisfy the desires of the individual in the local area.

Thermostats should be capable of readjustment and manipulation or relocation without the necessity of major labor expense each time they are changed. Automatic control systems seldom require any appreciable amount of power to actuate the controlling mechanisms. To reduce cost, therefore, and to add to the flexibility, the thermostats should be self-contained and derive their motivating power from some always immediate source. Such sources of energy could be the energy — or pressure — in the main air circulating system, the lighting system — by reconversion of unused light rays to motive energy — solar radiation, or even radio transmitted power. All such sources would be locally available without a network of interconnecting wires or pipes.

The development of a direct battery actuated by solar radiation has been recently announced by Bell Laboratories. This opens a wide area of investigation and speculation, not only for minor controls but for possible accumulation to operate major parts of the conditioning system. This discussion has not neglected, but eliminated for lack of space, discussion of such outlying principles as the heat pump, solar radiation absorption systems, panel cooling and heating and various other phases of air conditioning and its family.

Too often a building is designed by the architect and structural engineer before the mechanical engineer has a chance to arrange for the air conditioning system. As a consequence, too many compromises are necessary to squeeze the mechanical equipment into inadequate space. I think it is essential that all three designers work from the very beginning to incorporate all of the economies and flexibilities possible. An air conditioning system is no longer a postage stamp to be stuck on later. It is integral with and a part of the basic structure.

New Steel Boiler Code in Effect

. . . SBI votes approval

WITH SALES OF steel boilers currently equal to the volume at this time in 1953, confidence in a continued high level of sales of steel boilers of all types was expressed at the annual meeting of the Steel Boiler Institute.

R. A. Locke was re-elected president of the institute and E. I. Boardman, manager, Spencer Heater, Lycoming-Spencer Div., Avco Mfg. Corp., was elected vice president. Mr. Locke is SBI secretary-treasurer.

The sixth edition of the steel boiler code sponsored by the SBI became effective July 1. The code was formally approved at the meeting.

For the first time, scotch type boilers are included in the code. The new code also includes three large sizes of residential boilers up to 5000 sq ft of net steam, and three additional large sizes of commercial boilers.

L. N. Hunter, chairman of the engineering committee, reported on changes in the new code and pointed out that the net rating of automatically fired hot water boilers has been increased by 12½ per cent.

There was a joint meeting of the engineering committee with the boiler output committee of the Heating, Piping and Air Conditioning Contractors' National Association. The chief purpose of the meeting was to discuss cooperation on a joint code to rate boiler-burner units.

Urges "Demand Charge" for Air Conditioning Water

THE UNRESTRICTED use of water for air conditioning purposes has become a national problem that requires action, according to Frank C. Amsbary, vice president of the Northern Illinois Water Corp., testifying recently before the Illinois Commerce Commission in support of his company's proposed "demand charge" on unconserved water use in air conditioning.

As proposed, the demand charge would apply only to installations of three tons and larger, if water used for air conditioning is non-conserved. The charge, pending approval by the state commerce commission, would not take effect until May, 1955 with respect to air conditioning equipment presently installed.

As the chairman of a national committee of the American Water Works Association to study this problem, he urges that in the light of the generally anticipated enormous future of air conditioning in this country, the situation be faced while the industry "is still in its infancy. I honestly believe it would be unwise to delay facing the facts and providing now a suitable community-wide program that will assure an adequate supply of water for public health and safety without discrimination between various classes of water users," he says.

The facts, he points out, are that water plants historically have been designed primarily to furnish adequate quantities of safe water for all human needs and an adequate surplus over and above such human needs for the purpose of fire protection. To the extent that additional water is necessary for use in air conditioning, the surplus plant required for fire protection is correspondingly reduced.

"Generally speaking, in the ordinary water plant, approximately 70 percent of the investment in dollars is necessary to provide for human needs and about 30 percent of the investment is necessary to provide adequate fire protection to the municipality," he states.

Backbone of the proposed demand charge is the feeling that unless some action is taken to prevent unrestricted use of water for air conditioning purposes, in a short time the additional capacity of a water plant originally built and intended to be maintained for fire protection will be used for the purpose of supplying water for air conditioning equipment. "If no steps are taken before that point is reached, to restrict water usage for air conditioning purposes," says Mr. Amsbary, "it will mean that the water utility will probably have to expend at least 42 percent more of the invested dollars at that time to bring the water plant back to adequacy for public fire protection over and above the plant that is required for public health and human needs.

"While this would not be objectionable if such an investment were economically self-supporting, the committee of the AWWA has stated that a water utility should anticipate that the air conditioning load would last approximately 1000 hours in a year out of the total of 8760 hours in a year. This results in a load factor that is economically unprofitable and undesirable. The only way a water utility could continue to serve all of its customers without some kind of regulation would be to spread the carrying charge of this plant, which would be idle 7760 hours of the year, over the metered rate schedule payable by all consumers. This would result in assessing all of the water utility's customers for the benefit of the few who desire to use water for air conditioning purposes and would result in discrimination against those customers who do not use water for such air conditioning purposes.

"In one locality, the demand for water for air conditioning purposes has increased as much as 100 percent during the air conditioning hours in the commercial area. During the period of use, approximately 50 percent of the water used was going through air conditioning equipment and being discharged into the sewer system."

Various cities throughout the U.S. are rapidly taking steps to meet this water problem. There are three methods which have generally been used:

(1) Restriction of the amount of water to be discharged into the city sewer system from air conditioning systems.

(2) Forbidding the use of air conditioning equipment without the use of water conservation devices.

(3) Requiring a demand charge to be paid by customers who are using water for air conditioning purposes without having conservation devices to conserve such use.

The preferred method recommended by the AWWA committee in meeting and solving this problem is the demand charge for unconserved water use for air conditioning purposes, a charge sufficient to carry the excess idle plant necessary to furnish water for air conditioning purposes throughout the non-cooling months of the year.

Another AWWA committee, charged with the study of water rate structures, also recommends that demand charges be used and specifically refers to non-conserved water use in air conditioning as one type of load where this method should be instituted and adopted.

The company maintains that it would be more economical for a customer to install and operate one of the types of water conservation equipment than to pay for the demand charge plus the cost for the water used that is non-conserved. It is the company's expectation that most of the present users of air conditioning equipment, and all or substantially all of the future installers of air conditioning equipment, will use conservation devices.

"Final Report" on Piping Flexibility

THIS FINAL REPORT of the "Task Force" on piping flexibility is the text of the proposed rules for Chapter 3 of Section 6 of the Code for Pressure Piping. Section 6 of the Sectional Committee on the Code for Pressure Piping B31 is on fabrication details. This includes fabrication of pipe hangers, supports, anchors, sway bracings, and vibration dampers. It also includes the fabrication of pipe joints other than welded. Expansion and flexibility are covered as is welding of pipe joints and welded branch connections and fabricated or cast specials. However, the provisions of this chapter are not applicable to gas, air and oil cross-country transmission (underground) piping.

The Task Force is a group appointed by ASA Committee B31.1. The group engaged in this work has been guided by the results of research and practical experience since the conception of the present code. The intention of this committee has been to write regulations providing adequate safety without requiring extravagant use of materials, and at the same time to impose a minimum of restraint on procedure or method and avoid too stringent requirements regarding mathematical analysis.

The original draft developed by the Task Force was presented in the November 1953 HPAC, and an addendum to the report in the December 1953, HPAC. A preliminary draft had been distributed to approximately 150 members of the industry prior to the presentation in HPAC, which brought considerable comment of a constructive nature. After the comments were assembled, the text of the proposed rules given here was developed for presentation to the committee and to the industry before being adopted.

This final report is presented here so that HPAC's readers will have an opportunity to keep abreast of the development in this field of piping flexibility.

Text of Proposed Rules

[Note: The provisions of this chapter are not applicable to gas, air and oil cross-country (underground) piping.]

617 *Preamble.* (a) Piping systems are subject to a diversity of loadings creating stresses of different types and patterns, of which only the following more significant ones need generally be considered in piping stress analysis.

1. Pressure, internal or external.
2. Weight of pipe, fittings and valves, contained fluid and insulation, and other external loadings such as wind.
3. Thermal expansion of the line.

The first two loadings produce sustained stresses which are evaluated by conventional methods. The stresses due to thermal expansion on the other hand, if of sufficient initial magnitude, will be relaxed as a result of local flow in the form of yielding or in the form of creep. The stress reduction which has taken place will appear as a stress of reversed sign in the cold condition. This phenomenon is designated as self-springing of the line and is similar in effect to cold springing. The amount of such self-springing will depend on the magnitude of the initial hot stress and the temperature. Accordingly, while the hot stress tends to diminish with time, the sum of the hot and cold stresses during any one cycle will remain substantially constant. This sum is referred to as the stress range. The fact that the stress range is the determining factor leads to the selection of an allowable combined stress range in terms of the sum of the hot and cold S values.

Where due to severe service conditions or special configurations, excessive local strains may occur under prolonged heating in materials of limited ductility, the effect of such conditions should be considered. For example, it is possible to have a pipe line configuration with the following adverse conditions:

1) One or more branches which are small in size compared with the majority of the piping.

2) A calculated high expansion stress level in the small size branch with the remainder of the piping at relatively low expansion stress levels.

3) A relatively small elastic deformation in the small size branch coincident with the high expansion stress level; and a relatively large amount of absorbed expansion stored in the low stressed areas of the system to act as an elastic followup spring thereby maintaining elastic deformation on the small size, high expansion stressed area.

When all three of the above conditions exist, it is possible to produce an undesirable amount of creep in the small size, high expansion stressed area. Such undesirable creep could be avoided by a redesign of the piping or by judicious cold springing of the system.

Until more is known about the fabrication and treatment of austenitic steels, it is recommended that the design of piping systems of such materials be approached with greater overall care as to general elimination of local stress raisers, inspection, material selection, fabrication quality and erection. As a part of this approach, the need for hot plastic flow can be minimized by careful cold springing.

b) The beneficial effect of judicious cold springing in assisting the system to attain its most favorable condition sooner is recognized. Inasmuch as the life of a system under cyclic conditions depends primarily on the stress range rather than the stress level at any one time, no credit for cold spring is warranted with regard to stresses. In calculating end thrusts and moments acting on equipment containing moving or removable parts with close clearances, the actual reactions at any one time rather than their range are significant and credit accordingly is allowed for cold spring in the calculations of thrusts and moments.

618 *Materials.* (a) This chapter applies to all classes of materials permitted by the Code.

b) The thermal expansion range "e" shall be determined from Table X as the difference between the unit expansion shown for the maximum normal operating metal temperature and that for the minimum normal operating metal temperature — for

hot lines, this may usually be taken as the erection temperature. For materials not included in this table, reference shall be made to authoritative source data such as publications of the National Bureau of Standards.

c) The cold and hot moduli of elasticity, E_c and E_h, and the moduli of torsional rigidity, G_c and G_h, respectively, may be taken as the values shown for the minimum and maximum normal operating metal temperatures in Table Y for ferrous and Table Z for nonferrous materials in paragraph 623. For materials not included in these tables, reference shall be made to authoritative source data, such as publications of the National Bureau of Standards.

d) For flexibility calculations, Poisson's ratio may be taken as 0.3 at all temperatures for all ferrous materials.

e) The S values, S_c and S_h at the minimum and maximum operating metal temperatures, respectively, to be used for determining the allowable expansion stress range S_A shall be taken for the type of piping system involved from the applicable tables in the respective sections of the Code. In the case of welded pipe, the longitudinal joint efficiency may be disregarded in calculating expansion stresses.

619 *General.* a) Piping systems shall be designed to have sufficient flexibility to prevent thermal expansion from causing (1) failure from overstress of the piping material or anchors, (2) leakage at joints or (3) detrimental distortion of connected equipment resulting from excessive thrusts and moments.

b) Flexibility shall be provided by changes of direction in the piping through the use of bends, loops, and offsets; or provision shall be made to absorb thermal strains by expansion joints of the slip joint or bellows type.* If desirable, flexibility may be provided by creasing or corrugating parts or all of the pipe.

c) In order to modify the effect of expansion and contraction, runs of pipe may be cold sprung. Cold spring may be taken into account in the calculation of the reactions as shown in paragraph 621 d) provided an effective method of obtaining the designed cold spring is specified and used.

*In this case, anchors or ties of sufficient strength and rigidity shall be installed to provide for end forces due to fluid pressure and other causes.

TABLE X – THERMAL EXPANSION factors for commonly used materials

A = Mean Coefficient of Thermal Expansion x 10^6, (in./in./F)
B = Linear Thermal Expansion, (in./100 ft)
} In Going from 70 F to Indicated Temperature.

Material	Coeff.	Temperature Range, 70 F to —												
		70F	200F	300F	400F	500F	600F	700F	800F	900F	1000F	1100F	1200F	1300F	1400F
Carbon Steel Carbon-Moly Steel Low-Chrome Steels- (Through 3% Cr)	A	—	6.38	6.60	6.82	7.02	7.23	7.44	7.65	7.84	7.97	8.12	8.19	8.28	8.36
	B	0	0.99	1.82	2.70	3.62	4.60	5.63	6.70	7.81	8.89	10.04	11.10	12.22	13.34
Intermediate Alloy Steels 5Cr Mo Through 9 Cr Mo	A	—	6.04	6.19	6.34	6.50	6.66	6.80	6.96	7.10	7.22	7.32	7.41	7.49	7.55
	B	0	0.94	1.71	2.50	3.35	4.24	5.14	6.10	7.07	8.06	9.05	10.00	11.06	12.05
Austenitic Stainless Steels	A	—	9.34	9.47	9.59	9.70	9.82	9.92	10.05	10.16	10.29	10.39	10.48	10.54	10.60
	B	0	1.46	2.61	3.80	5.01	6.24	7.50	8.80	10.12	11.48	12.84	14.20	15.56	16.92
Straight Chromium Stainless Steels 12Cr, 17Cr and 27Cr	A	—	5.50	5.66	5.81	5.96	6.13	6.26	6.39	6.52	6.63	6.72	6.78	6.85	6.90
	B	0	0.86	1.56	2.30	3.08	3.90	4.73	5.60	6.49	7.40	8.31	9.20	10.11	11.01
25 Cr – 20 Ni	A	—	7.78	7.92	8.08	8.22	8.38	8.52	8.68	8.81	8.92	9.00	9.08	9.12	9.18
	B	0	1.21	2.18	3.20	4.24	5.33	6.44	7.60	8.78	9.95	11.12	12.31	13.46	14.65
Monel 67 Ni – 30 Cu	A	—	7.84	8.02	8.20	8.40	8.58	8.78	8.96	9.16	9.34	9.52	9.70	9.88	10.04
	B	0	1.22	2.21	3.25	4.35	5.46	6.64	7.85	9.12	10.42	11.77	13.15	14.58	16.02
Monel 66 Ni – 29 Cu Al	A	—	7.48	7.68	7.90	8.09	8.30	8.50	8.70	8.90	9.10	9.30	9.50	9.70	9.89
	B	0	1.17	2.12	3.13	4.17	5.28	6.43	7.62	8.86	10.16	11.50	13.00	14.32	15.78
Aluminum	A	—	12.95	13.28	13.60	13.90	14.20								
	B	0	2.00	3.66	5.39	7.17	9.03								
Gray Cast Iron	A	—	5.75	5.93	6.10	6.28	6.47	6.65	6.83	7.00	7.19				
	B	0	0.90	1.64	2.42	3.24	4.11	5.03	5.98	6.97	8.02				
Bronze	A	—	10.03	10.12	10.23	10.32	10.44	10.52	10.62	10.72	10.80	10.90	11.00		
	B	0	1.56	2.79	4.05	5.33	6.64	7.95	9.30	10.68	12.05	13.47	14.92		
Brass	A	—	9.76	10.00	10.23	10.47	10.69	10.92	11.16	11.40	11.63	11.85	12.09		
	B	0	1.52	2.76	4.05	5.40	6.80	8.26	9.78	11.35	12.98	14.65	16.39		
Wrought Iron	A	—	7.32	7.48	7.61	7.73	7.88	8.01	8.13	8.29	8.39				
	B	0	1.14	2.06	3.01	3.99	5.01	6.06	7.12	8.26	9.36				
Cu-Ni (70-30)	A	—	8.54	8.71	8.90										
	B	0	1.33	2.40	3.52										

TABLE Y – MODULI OF ELASTICITY and torsional rigidity of ferrous material

E = Modulus of Elasticity – Multiply Values by 10^6
G = Modulus of Torsional Rigidity – Multiply Values by 10^6

Material	Modulus	Temperature, F												
		70	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400
Carbon Steels With Carbon Content 0.30% or Less	E	27.9	27.7	27.4	27.0	26.4	25.7	24.8	23.4	18.5	15.4	13.0			
	G	10.8	10.7	10.6	10.4	10.2	9.9	9.6	9.0	7.1	5.9	5.0			
Carbon Steels With Carbon Content Above 0.30%	E	29.9	29.5	29.0	28.3	27.4	26.7	25.4	23.8	21.5	18.8	15.0	11.2		
	G	11.6	11.4	11.2	10.9	10.7	10.3	9.8	9.2	8.3	7.2	5.7			
Carbon-Moly Steels, Low Cr-Moly Steels, Through 3% Cr	E	29.9	29.5	29.0	28.6	28.0	27.4	26.6	25.7	24.5	23.0	20.4	15.6		
	G	11.6	11.4	11.2	11.0	10.8	10.6	10.2	9.9	9.4	8.8	7.8	5.9		
Intermediate Cr-Moly Steels (5%-9% Cr), Austenitic Stainless Steel	E	27.4	27.1	26.8	26.4	26.0	25.4	24.9	24.2	23.5	22.8	21.9	20.8	19.5	18.1
	G	10.6	10.4	10.3	10.1	9.9	9.7	9.5	9.2	8.9	8.6	8.3	7.8	7.3	6.7
Straight Chromium Stainless Steel (12Cr, 17Cr, 27Cr)	E	29.2	28.7	28.3	27.7	27.0	26.0	24.8	23.1	21.1	18.6	15.6	12.2		
	G	11.4	11.2	11.0	10.8	10.5	10.1	9.6	9.0	8.2	7.2	6.0	4.7		
Wrought Iron	E	29.5	28.6	28.2	27.7	27.0	26.5	25.8	23.0						
	G	11.8	11.6	11.5	11.4	11.2	10.9	10.6	9.9						
Gray Cast Iron	E	13.4	13.2	12.9	12.6	12.2	11.7	11.0	10.2						
	G	No Data Available													

TABLE Z – MODULI OF ELASTICITY and torsional rigidity of non-ferrous material

E = Modulus of Elasticity – Multiply Values by 10^6
G = Modulus of Torsional Rigidity – Multiply Values by 10^6

Material	Modulus	Temperature, F											
		70	100	200	300	400	500	600	700	800	900	1000	1100	1200
Monel – 67 Ni – 30 Cu 66 Ni – 29 Cu, Al	E	26.0	26.0	26.0	25.8	25.6	25.4	24.7	23.1	21.0	18.6	16.0	14.3	13.0
	G	9.5	9.5	9.3	9.1	8.9	8.7	8.5	8.2	7.9				
Copper-Nickel 80-20, 70-30	E	18.9	18.8	18.4	18.0	17.6	17.2	16.7	16.2	15.3				
	G	No Data Available												
Aluminum	E	10.6	10.6	10.4	10.2	9.5	8.5							
	G	3.9	3.9	3.8	3.7	3.5	3.1							
Copper 99.98% Cu	E	16.0	15.8	15.6	15.4	15.1	14.7	14.2	13.7					
	G	6.03	6.00	5.90	5.65	5.45	5.30							
Commercial Brass 66 Cu, 34 Zn	E	14.0	13.9	13.7	13.5	13.0	12.7	12.2	11.8					
	G	5.47	5.25	5.10	4.90	4.72	4.58							
Leaded Tin Bronze 88 Cu, 6Sn, 1.5Pb & 4.5 Zn	E	13.0	12.9	12.7	12.4	12.0	11.7	11.3	10.9					
	G	4.89	4.82	4.65	4.52	4.40	4.72							

620 *Basic Assumptions and Requirements.* (a) Formal calculations or model tests shall be required where reasonable doubt exists as to the adequate flexibility of a system. Each problem shall be analyzed by a method appropriate to the conditions.

No hard and fast rule can be given as to when an analysis should be made. However, in the absence of better information, the need for a formal stress analysis for a two anchor system of uniform pipe size is indicated when the following approximate criterion is not satisfied.

$$(DY)/(L - U^2) \leqq 0.03$$

where D = nominal pipe size, in.; Y = resultant of movements to be absorbed by pipe line, in.; U = anchor distance — length of straight line joining anchors —, ft; L = developed length of line axis, ft.

The requirements for analysis shall be considered satisfied for duplicate units of successfully operating installations or for replacements of piping systems with a record of satisfactory service.

b) Standard assumptions and requirements are given in paragraphs (d) to (g). Where simplifying assumptions are used in calculations or model tests, the likelihood of attendant underestimates of forces, moments and stresses including the effects of stress intensification shall be taken into account.

c) In calculating the flexibility of a piping system between anchor points, the system shall be treated as a whole. The significance of all parts of the line and of all restraints such as solid hangers or guides, including intermediate restraints introduced for the purpose of reducing moments and forces on equipment or small branch lines, shall be recognized.

d) Calculations shall take into account stress intensification factors found to exist in components other than plain straight pipe. Credit may be taken for the extra flexibility of such components. In the absence of more directly applicable data, the flexibility factors k and stress intensification factors i shown in Chart 1 may be used.

e) Dimensional properties of pipe and fittings as used in flexibility calculations, shall be based on nominal dimensions. The pressure stresses for services subject to severe corrosion shall be based on the reduced thickness of the pipe.

f) The total expansion range from the minimum to the maximum normal operating temperature shall be used in all calculations, whether piping is cold sprung or not. Not only the expansion of the line itself, but also linear and angular movements of the equipment to which it is attached, shall be considered.

g) Calculations for the expansion stress S_E shall be based on the modulus of elasticity of E_c at room temperature.

621 *Stresses and Reactions.* (a) Using the foregoing assumptions, the stresses and reactions due to expansion shall be investigated at all significant points.

b) The expansion stresses shall be combined in accordance with the following formula:

Description	Flexibility Factor "k"	Stress Intensification Factor
Butt Welded Joint, Reducer, or Welding Neck Flange	1	1.0
Double-Welded Slip-On or Socket Weld Flange	1	1.2
Fillet Welded Joint, or Single-Welded Socket Weld Flange	1	1.3
Lap Joint Flange (with ASA B16.9 lap joint stub)	1	1.6
Screwed Pipe Joint, or Screwed Flange	1	2.3
Corrugated straight Pipe, or Corrugated or Creased Bend[5]	5	2.5

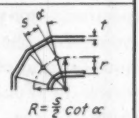
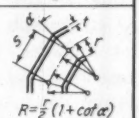
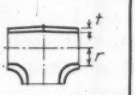
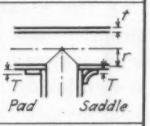
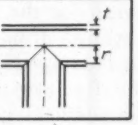
Description	Flexibility Factor "k"[4]	Stress Intensification Factor "i"[5,6]	Flexibility Characteristic "h"	Sketch
Welding Elbow,[1,2,3] or Pipe Bend	$\frac{1.65}{h}$	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{tR}{r^2}$	
Mitre Bend,[1,2,3] with close spacing: $s<r(1+\tan\alpha)$	$\frac{1.52}{h^{\frac{5}{6}}}$	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{\cot\alpha}{2}\,\frac{ts}{r^2}$	 $R=\frac{s}{2}\cot\alpha$
Mitre Bend,[1,2,4] with wide spacing: $s \geqq r(1+\tan\alpha)$	$\frac{1.52}{h^{\frac{5}{6}}}$	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{1+\cot\alpha}{2}\,\frac{t}{r}$	 $R=\frac{r}{2}(1+\cot\alpha)$
Welding Tee[1,2] per ASA B16.9	1	$\frac{0.9}{h^{\frac{2}{3}}}$	$4.4\,\frac{t}{r}$	
Reinforced Fabricated Tee[1,2] (with pad or saddle)	1	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{(t+\frac{1}{2}T)^{\frac{5}{2}}}{t^{\frac{3}{2}}r}$	 Pad Saddle
Unreinforced Fabricated Tee[1,2]	1	$\frac{0.9}{h^{\frac{2}{3}}}$	$\frac{t}{r}$	

CHART 1—FLEXIBILITY FACTORS k and stress intensification factors i

[1]The flexibility factors k and stress intensification factors i in the table apply to bending in any plane for fittings of the same nominal weight or schedule as the pipe used in the system, and shall in no case be taken less than unity; factors for torsion equal unity. Both apply over the effective arc length (shown by heavy dash-dot lines in the sketches) for curved and mitre elbows, and to the intersection point for tees.

[2]The values of k and i can be read directly from chart, entering with the characteristic h computed from the formulas given, where:

R = bend radius of welding elbow or pipe bend
r = mean radius of matching pipe
t = wall thickness of matching pipe
a = one-half angle between adjacent mitre axes
s = mitre spacing at center line
T = pad or saddle thickness

[3]Where flanges are attached to one or both ends, the values of k and i in the table shall be corrected by the factors C given below, which can be read directly from chart, entering with the computed h:

One end flanged: $h^{1/6}$ Both ends flanged: $h^{1/3}$

[4]Also includes single-mitre joint.

[5]Factors shown apply to bending; flexibility factor for torsion equals 0.9.

[6]The stress intensification factors i in the table were obtained from tests on full size outlet connections. For less than full size outlets, the full size values should be used until more applicable values are developed.

All dimensions in inches.

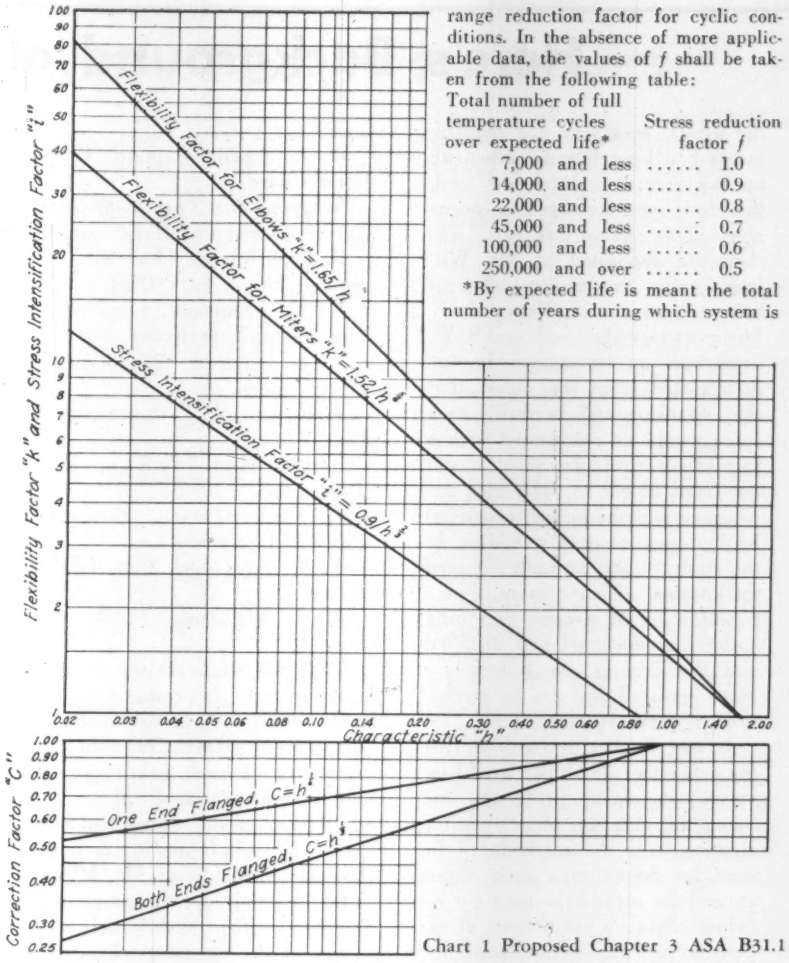

Flexibility Factor "k" and Stress Intensification Factor "i"
Flexibility Factor for Elbows "k" = 1.65/h
Flexibility Factor for Miters "k" = 1.52/h
Stress Intensification Factor "i" = 0.9/h
Characteristic "h"
Correction Factor "C"
One End Flanged, C = h
Both Ends Flanged, C = h

Chart 1 Proposed Chapter 3 ASA B31.1

range reduction factor for cyclic conditions. In the absence of more applicable data, the values of f shall be taken from the following table:

Total number of full temperature cycles over expected life*	Stress reduction factor f
7,000 and less	1.0
14,000 and less	0.9
22,000 and less	0.8
45,000 and less	0.7
100,000 and less	0.6
250,000 and over	0.5

*By expected life is meant the total number of years during which system is expected to be in active operation.

$$S_E = (S_b^2 + 4\,S_t^2)^{\frac{1}{2}}$$

where $S_b = i\,M_b/Z$ = resultant bending stress, psi; $S_t = M_t/2Z$ = torsional stress, psi; M_b = resultant bending moment, in. lb; M_t = torsional moment, in. lb; Z = section modulus of pipe, in.^{3}; i = stress intensification factor.

c) The maximum computed expansion stress, S_E, based on 100 percent of the expansion and E_C for the cold condition, shall not exceed the allowable stress range, S_A, where

$$S_A = f\,(1.25\,S_c + 0.25\,S_h)$$

The sum of the longitudinal stresses due to pressure, weight and other sustained external loadings shall not exceed S_h. Where the sum of these stresses is less than S_h, the difference between S_h and this sum may be added to the term 0.25 S_h in the formula above.

In the above formula:

S_c = allowable stress (S value) in the cold condition, S_h = allowable stress (S value) in the hot condition. (S_c and S_h are to be taken from tables in the applicable sections of the Code.) f = stress

d) The reactions — forces and moments — R_h and R_c in the hot and cold conditions, respectively, shall be obtained as follows from the reactions R derived from the flexibility calculations based on the modulus of elasticity at room temperature E_c.

$$R_h = (1 - 2C/3) \times (E_h/E_c) \times R$$

$$R_c = CR, \text{ or}$$

$$R_c = [1 - (S_h/S_E)\ (E_c/E_h)] \times R$$

whichever is greater, and with the further condition that

$(S_h/S_E) \times (E_c/E_h)$ is less than one

where C = cold spring factor varying from zero for no cold spring to one for 100 percent cold spring, S_E = maximum computed expansion stress, E_c = modulus of elasticity in the cold condition, E_h = modulus of elasticity in the hot condition, R = range of reactions corresponding to the full expansion range based on E_c, R_c and R_h represent the maximum reactions estimated to occur in the cold and hot conditions, respectively.

e) The reactions so computed shall not exceed limits which the attached equipment can safely sustain.

622 *Supports.* (a) Pipe supports and restraints not expressly considered in flexibility calculations shall be designed to minimize interference with the thermal expansion of the line.

b) The design and spacing of supports shall be checked to assure that the sum of the longitudinal stresses due to weight, pressure and other sustained external loading does not exceed S_h.

623 *Elastic Constants and Coefficients of Thermal Expansion.* The coefficients of thermal expansion and values of linear expansion per 100 ft are given in Table X. The moduli of elasticity and the moduli of torsional rigidity are given for various materials in Table Y for ferrous materials and Table Z for nonferrous.

Case 13 Revised

Case 13 has been revised as follows. This information revises that contained in the June HPAC when Case 13 was reopened.

Inquiry: What is the status of the "Report of the Task Force on Flexibility, June 21, 1954" as it relates to the previous report of May 4, 1953 and paragraph 620 in the 1951 edition of the code for pressure piping?

Reply: It is the opinion of the committee that in view of the June 21, 1954 report being the final opinion of the task force on flexibility, that until the new 1955 edition of the code for pressure piping is published revising paragraph 620, the June 21, 1954 report should be used in designing any new projects. For designs already completed and those in progress, any one of the following procedures will meet the intent of the code as it applies to piping flexibility:

(a) Follow the wording of paragraph 620 of the ASA B31.1 1951 code.

(b) Follow the proposed revised wording given in the "Report of Task Force on Flexibility, May 4, 1953".

(c) Follow the proposed wording in the May 4, 1953 task force report, except using the alternate paragraphs contained in the report.

(d) Follow the June 21, 1954 report.

Here's Background of

BACK IN April 1951, two task forces were appointed to investigate two problems of primary importance in the field of pressure piping. These task forces were appointed by F. S. G. Williams, chairman of American Standards Association B31 sectional committee on code for pressure piping.

Wall Thickness Task Force

The first of these task forces, headed by D. G. Reid, was established for the purpose of resolving differences in point of view concerning criteria to be used in calculating the wall thicknesses of high pressure, high temperature piping. After considerable study and discussion, this task force recommended a modified formula for pipe wall thickness which was adopted by the American Society of Mechanical Engineers' boiler code committee as well as for sections of the ASA B31 piping code to which it is applicable. The recommendations of the task force are ably presented in a paper by W. R. Burrows, R. Michel and A. W. Rankin appearing in the Transactions of the ASME of April 1954, Vol. 76, No. 3.

This work has eliminated the confusion existing in the past when different formulas for determining the pipe wall thickness of power piping were used by different responsible authorities, such as the U.S. Navy, the U.S. Coast Guard, the American Bureau of Shipping, the ASME, the ASA, etc.

The new formula is based on sound technical and practical reasoning and was only agreed upon after a thorough study of not less than 31 different formulas. Real progress has been accomplished and all members of this task force deserve the appreciation of industry for the labors which brought about this result.

Task Force on Flexibility

The second task force was appointed to formulate new rules governing the subject of expansion and flexibility. While the ASA B31.1-1951 code did cover the subject in a way, the requirements had been found inadequate as the industry developed and, therefore, revision seemed desirable. This second task force was therefore appointed by Mr. Williams under the chairmanship of Sabin Crocker with Henry C. E. Meyer as vice chairman and S. W. Spielvogel as secretary. It was appreciated from the outset that the expansion and flexibility task force would be confronted with a formidable problem, since it did not have access to such vast experience and theoretical historical background as was available in the study of the formula for pipe thicknesses. Furthermore, the combination of stresses in piping systems as designed and installed and the criteria for failure are more involved and not so susceptible to verification by test.

It was further recognized that the subject of flexibility would involve two major problems, one being the question of permissible stresses, and the methods to be used for determining such stresses, and the second the need for up to date data on coefficients of expansion and physical constants for the various materials commonly used in power piping. Hence, the work was divided between two subgroups as follows:

Subgroup No. 1 on Stresses and Reactions

H. C. E. Meyer, chairman, Gibbs & Cox, Inc.

S. W. Spielvogel, secretary, Consolidated Edison Co.

Norman Blair, Bechtel Corp.

J. D. Conrad, Westinghouse Electric Corp.

Arthur Edwards, Stone & Webster Engineering Corp.

John W. Heck, American Bureau of Shipping.

Arthur McCutchan, Tube Turns, Inc.

A. R. C. Markl, Tube Turns, Inc.

Rudolph Michel, Bureau of Ships, Navy Dept.

A. W. Rankin, General Electric Co.

H. V. Wallstrom, M. W. Kellogg Co.

R. A. Smyth, Captain, U. S. Coast Guard.

Subgroup No. 2 on Coefficients, Expansion and Physical Constants

Rudolph Michel, Chairman, Bureau of Ships, Navy Dept.

E. C. Chapman, Combustion Engineering-Superheater, Inc.

J. D. Conrad, Westinghouse Electric Corp.

J. E. Lattan, Taylor Forge & Pipe Works.

Arthur McCutchan, Tube Turns, Inc.

G. Sinding-Larsen, Pittsburgh Piping & Equipment Co.

S. W. Spielvogel, Consolidated Edison Co.

H. V. Wallstrom, M. W. Kellogg Co.

Both subgroups started their respective tasks as promptly as possible, and a considerable exchange of correspondence between the members of each subgroup and their chairmen took place, but until 1952 most progress had been made by subgroup No. 2, under the chairmanship of Mr. Michel, who had developed a great mass of data on the physical characteristics of various materials.

Subgroup No. 1 had, in the meanwhile, been engaged in establishing a new approach to the evaluation of the expansion stresses in the light of the latest experience by introducing the concept of stress range which conforms more rationally to the actual behavior of piping at elevated temperature than the previous limitation of an allowable combined stress.

It was also considered advisable to provide tables of elastic constants and expansion coefficients. Stress range reduction factors for cyclic conditions, stress intensification and flexibility factors were also considered, it being understood that the data given were based on present knowledge and that if and when better information was available as the result of experience or test, such data could be applied.

It soon became apparent that

Piping Flexibility Report

the accumulated information could hardly be correlated and embodied in a satisfactory text through discussions in a large group. Chairman Meyer of subgroup No. 1, therefore, appointed a working group to prepare a preliminary draft of proposed new regulations which would be in accord with modern understanding of the problem and which could be a basis for discussion by the subgroup as a whole. This working group consisted of S. W. Spielvogel, A. R. C. Markl, H. V. Wallstrom and Norman Blair.

Text to be Simple

It was emphasized at the outset that, in preparing a satisfactory text for use in the ASA code, it should be kept in mind that:

(1) Code requirements must be kept simple and never develop into a text book.

(2) Rules should be phrased in such a manner as to be readily understandable.

(3) Mandatory requirements should be as few as practicable, since mandatory regulations have a pernicious tendency to grow in complexity with resulting difficulties in interpretation and application.

(4) The primary purpose is to furnish a guide for avoiding dangerous conditions arising in piping systems but without hampering the designer with regulations which in such a complex matter might actually do more harm than good.

This working group took up its assignment during the summer of 1952 and was able to report substantial progress by December 1952. Between the latter part of 1952 and the early months of 1953, meetings were held of subgroup No. 1 as a whole. At these meetings, the preliminary text developed by the working group was revised to meet the views of the entire membership of the subgroup with the result that an amended text was presented to the executive committee in April 1953. This text was approved for submission to industry for review, and notices were published stating that copies of what was designated as the May 4, 1953 report were available to those interested in the subject. As a result of these notices, 600 copies of this report were distributed, indicating a wide interest in the subject matter.

At the 1953 annual meeting of the ASME, Paper No. 53-A-51 by A. R. C. Markl and Paper No. 53-A-52 by Rudolph Michel were presented to thoroughly expound the reasoning behind the work of the respective subgroups. As a result of these papers and the 600 copies of the May 4, 1953 report that were distributed, many comments were received from industry from the time of the first issuance of the proposed text until early in 1954, when this correspondence became so voluminous that in order to expedite the work, Chairman Meyer of subgroup No. 1 called on another special group to assist him in analyzing the various comments. This group consisted of S. W. Spielvogel, H. V. Wallstrom and O. Nielsen (Nonmember, of Gibbs & Cox, Inc.)

Two meetings were held by these men to analyze the comments that had been received and to condense them into a single report which was sent to all members of subgroups Nos. 1 and 2. After a short time for consideration of these comments, a meeting of the members of subgroup No. 1 was called, and the text was revised to meet as far as practicable the constructive suggestions submitted by industry and any further comments by the members of the subgroup. A revised text submitted to the executive committee in March 1954 was accepted for publication, including the tables of physical constants and expansion values produced by subgroup No. 2.

During April 1954, a number of communications were received. When these comments were of a general editorial nature, they could be readily dealt with. However, some of the letters brought out the point that for low operating temperatures the permissible stresses could become quite high.

After consideration by a working subcommittee, this problem was presented to subgroup No. 1, and a consensus reached that the formulas as proposed are essentially satisfactory and that only minor editorial clarification is required. This amplification has been incorporated in the present report as presented under date of June 21, 1954.

The following explanatory remarks explain why this action was agreed upon:

"It must be recognized that, while the formula for S_A determines the allowable stress range, the maximum combined stress may reach a value of 2.5 S_c where the temperature is 650 F and below for power piping or for oil piping up to 100 F.

"However it is also true that the attainment of these high stress values can only occur in very stiff piping in the cold condition with 100 percent cold pull-up or in the hot condition with zero cold pull-up and when E_c and E_h are substantially equal. Where such high stresses exist, the major part of the stress is flexure stress due to expansion and is therefore extremely local. These locally high stresses may result in a slight deformation which, however, is not anywhere as severe as occurs in bending a pipe cold. Therefore, these highly localized stresses should not result in failure of the pipe."

Copies of this report, entitled New Flexibility Section, ASA Code for Pressure Piping, dated June 21, 1954 including the tables, can be obtained free of charge from the ASME offices, 29 W. 39th St., New York 18. The revised Chapter 3 as given in the June 21, 1954 report is now considered ready for application and no further changes are contemplated until it is necessary to make modifications as a result of its having been in force for some years.

Steam Vacuum Refrigeration

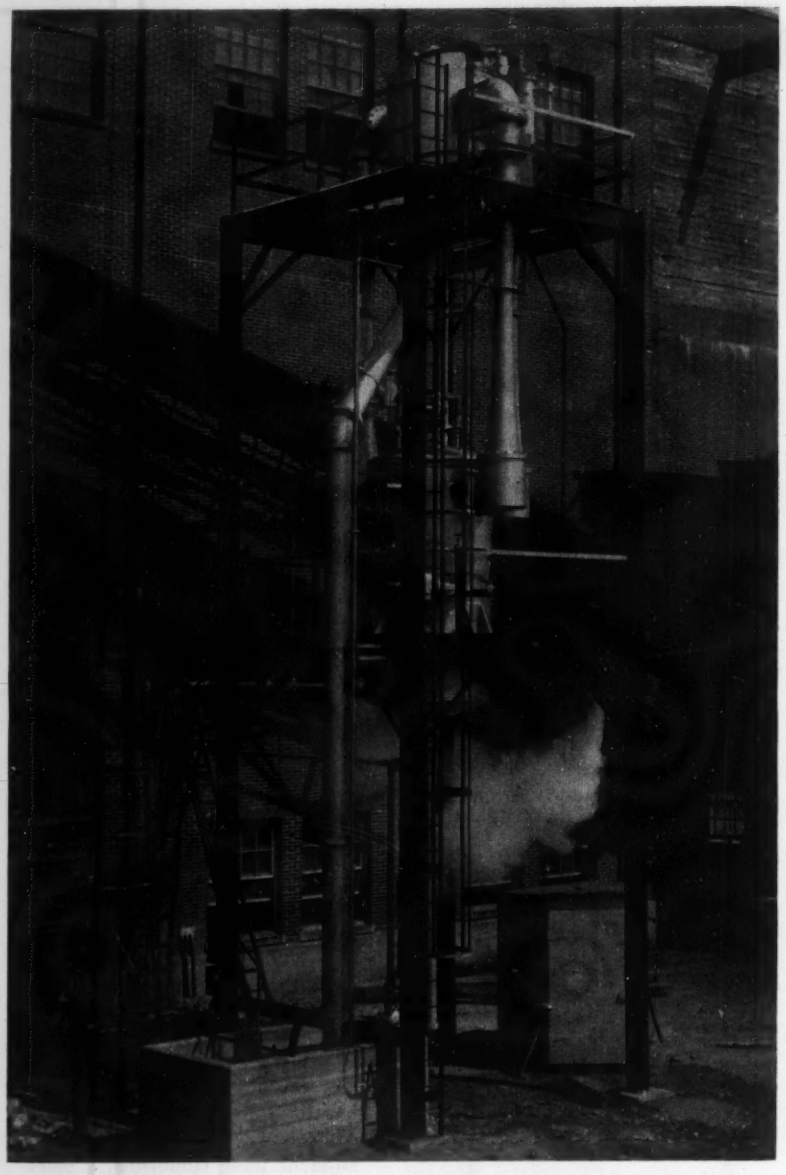
Its principle of operation, uses, performance, etc.

By Elliot Spencer
Graham Mfg. Co., Inc.

• **Steam vacuum refrigerating systems prove economical, says Mr. Spencer, if all factors such as first cost, utility costs, interest and amortization of investment, need for operating attention and seasonal economy are considered.**

Steam vacuum systems are most suitable when the system may be installed next to a source of water and when steam is available as waste steam or at a low cost. Careful evaluation of all factors, keeping in mind the reliability of these systems, should be made before reaching a decision.

The factors and pointers that are presented here in this first of two articles on the subject by Mr. Spencer are the principle of operation, operating costs and selection of the equipment. A number of applications are also described.



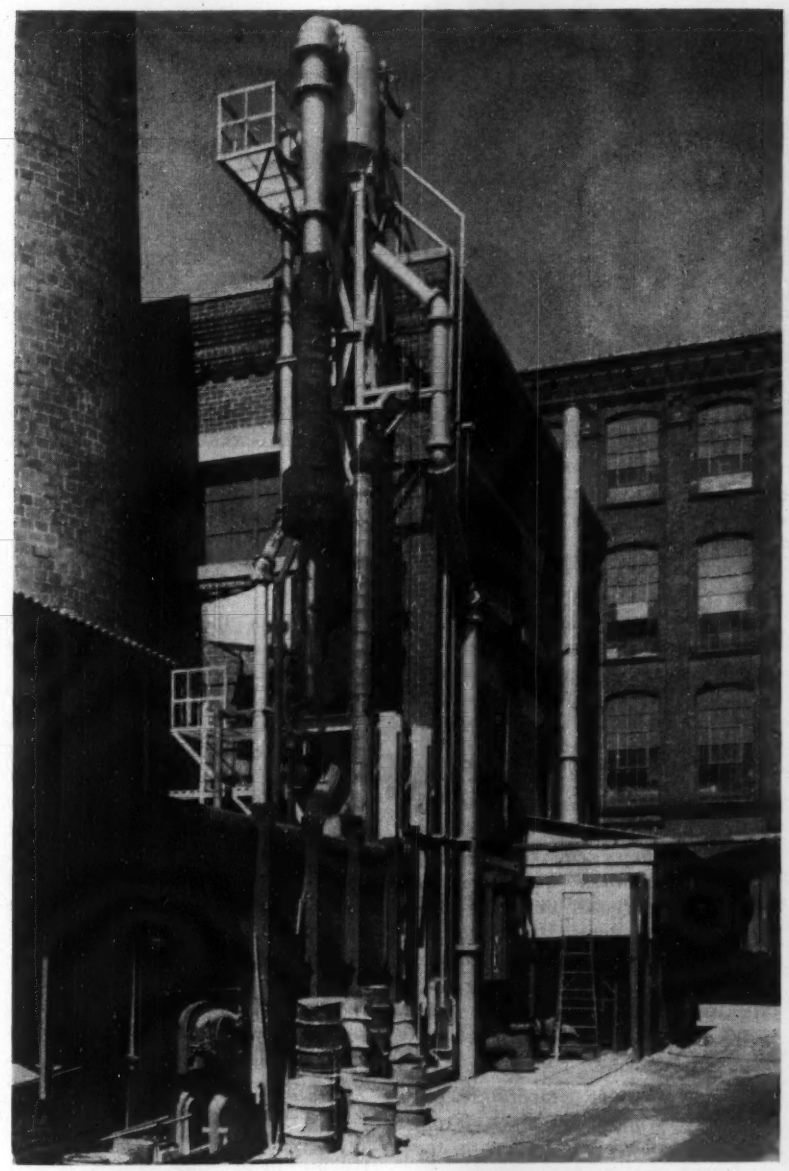
THIS THREE-EJECTOR steam vacuum refrigeration system with barometric condenser is installed at an eastern paper mill. Note the 30 deg bend in the tail pipe, and the concrete hot well

ALTHOUGH the principle and use of steam vacuum refrigeration dates back to the early 1900's, it is treated today as somewhat of a textbook curiosity by some heating and air conditioning engineers. It was not until the period of 1933 to 1938 that this system was used rather extensively in industrial applications. Recently, interest has been increasing in this system; this stems from a number of factors.

Of primary importance in this renewed interest has been the increasing need for refrigeration at temperatures above 32 F — the lower limit of the steam vacuum refrigeration application.

Another major factor in this resurgence has been the tremendous expansion of the chemical and process industries with their year' round high temperature cooling loads and readily available low cost process steam — which two factors make this field a natural for steam vacuum refrigeration. Pharmaceutical industries and food processors, particularly the juice concentrators, have readily adapted steam vacuum refrigeration to their needs.

Experience with high vacuum ejectors in many chemical and process



A DENTAL MATERIALS manufacturer uses this single jet steam vacuum refrigeration system which is integrated with the building and other equipment

industries has shown that these devices are reliable, and that maintenance costs and operational attention are practically insignificant.

Not the least important factor in this revival are the improvements in design which have been made in the system itself and in the controls and accessory equipment required for its proper operation. Much of this advance has been a direct result of the experience garnered from the expanded use of high vacuum steam ejectors in these applications.

Widespread use of steam vacuum refrigeration was limited by the inefficiency of the early steam jet ejectors. Further limitations were imposed by the lack of availability of suitable accessory equipment such as pumps and controls which were then still in their development stages.

With the advent of large scale high vacuum operations, brought about by the tremendous expansion of the chemical and process industries, steam ejectors received the engineering attention which brought them to their present state of efficiency and reliability.

Principle of Operation

The principle of operation of a steam vacuum refrigeration system is simple. At any given pressure, water has a corresponding boiling point. If the pressure is lowered to 0.1475 psia, for example, water will boil at 45 F. This is accomplished by means of the steam jet ejector in the system.

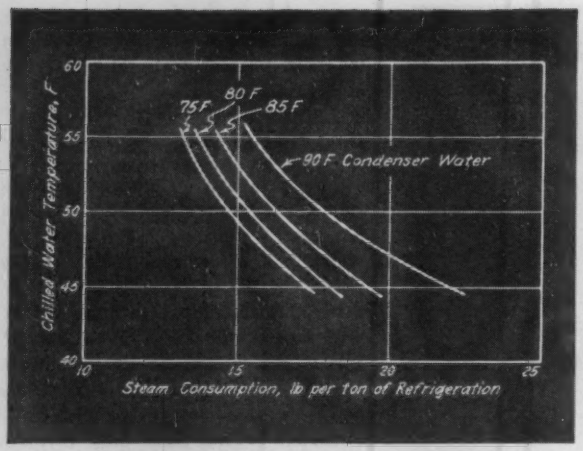
The warm water to be chilled is admitted to the flash tank through which it flows to the distributors. The vacuum on the flash tank is produced by the booster steam jet ejector that draws off all flashed vapors and discharges these vapors to the main condenser. Propelling steam, either high or low pressure — as low as 2 psig — is admitted to the booster. A lower vacuum — as compared to the flash tank vacuum — is maintained on the main condenser by the two stage ejector with its intercondenser. This ejector may be operated at steam pressures of 35 psig or higher.

The water thus chilled by flashing off these vapors falls to the bottom of the flash tank and is removed from service by a hotwell type centrifugal pump. The level in the flash tank is maintained by a liquid level controller.

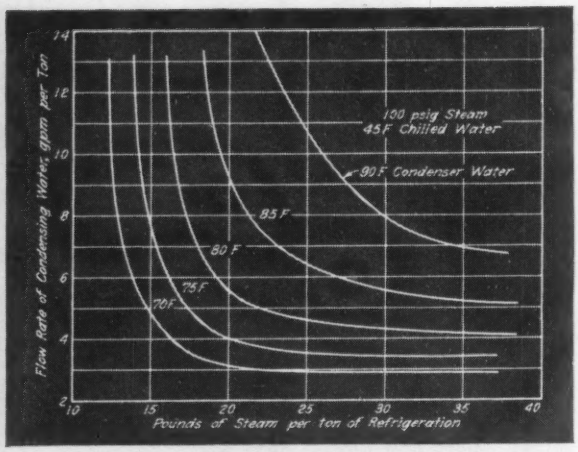
Operating Cost and Selection

In order to determine the advisability of using a steam vacuum refrigeration system for a proposed installation, it is necessary to understand the factors which affect the operation and cost of this system. If the prospective user has an adequate supply of steam and water available at a reasonable cost and wishes to produce water or a refrigerated product temperature above 35 F, it is logical to consider the use of steam vacuum refrigeration.

The most important factor affecting the performance of these systems is the chilled water temperature which it is desired to obtain. As the chilled water temperature drops, the lb of steam per ton increases, as shown in Fig. 1. This is to be expected since all refrigeration systems require added power with re-



1 THE PERFORMANCE of steam vacuum refrigeration systems is largely governed by the chilled water temperature which it is desired to obtain. As the chilled water temperature drops, the steam consumption increases



2 AS THE CONDENSER water temperature decreases, the steam rate per ton of refrigeration drops appreciably for a given flow rate of condensing water

duced chilled water temperature. Steam vacuum refrigeration, however, is somewhat more affected by lower chilled water temperatures, and it is advisable to select the highest chilled water temperature compatible with other requirements. Conversely, at higher chilled water temperatures, the efficiency of steam vacuum refrigeration systems is higher.

The chilled water flow rate, on the other hand, has little effect on chiller performance. The water flow rate in gpm per ton may vary widely without any appreciable effect on equipment selection. However, chilled water temperature and water flow rate should be fixed when the equipment is specified, since the distribution system in the evaporator must be selected for the proper flow. When the chilled water range gets as high as 20 F, two stage flashing is used.

In conventional refrigeration systems using shell and tube exchangers, high flow rates also mean high tube velocities, which good practice limits to 8 to 10 fps. High velocities mean high pressure drops. Narrow temperature ranges of the water also mean low mean temperature differences between entering and leaving water and evaporator temperatures. This increases the size of the exchanger, since with a reduced mean temperature difference more exchanger surface is required.

Steam vacuum refrigeration is an evaporative process and can tolerate widely varying inlet temperatures. Outlet water temperature is the all important determining factor.

Effect of Water Temperature

The second important factor is that of condenser water temperature. Steam vacuum systems require relatively larger water quantities for condensing purposes than do other refrigeration systems. High condenser water inlet temperature affects this system much the same as it does other refrigeration systems, resulting in lower efficiency and larger equipment requirements.

Condenser water temperature has another very important effect. From Fig. 2, it may be seen that as the condenser water temperature decreases, the steam rate per ton of refrigeration drops appreciably for a given flow rate of condensing water. In process work, where loads remain relatively constant without regard to outside temperature, this saving is important. Since the system runs all year 'round, and since it is selected for the maximum condenser water temperature, it runs at a much more efficient level during a large part of the year.

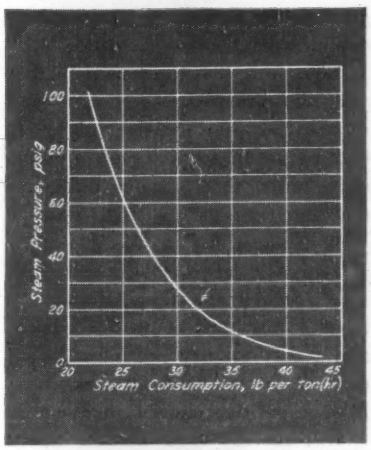
In view of the large effect that condenser water temperature has as compared to the effect of condenser water temperatures in other systems, it is seen that to properly evaluate steam vacuum refrigeration system utility costs, the effect of reduced consumption during much of the year should be considered in an analysis.

When the condenser water is taken from a river, lake or ocean — such that the temperature of the water is equal to the chilled water temperature — it is then possible to shut the booster ejector off entirely. Then, the system may be operated on the secondaries alone, resulting in a reduction in steam consumption equivalent to 95 percent of the maximum requirement. In some localities — particularly those in the northern regions of our country — this condition may continue for several months of the year, thus releasing steam for winter heating uses. Of course, when the condenser water reaches these temperatures, it may be used directly and the evaporator may be shut down — providing the water source is free of foreign matter.

The importance of evaluating steam vacuum refrigeration systems by taking these factors into consideration cannot be over-emphasized. This holds true even for cooling tower installations where the effect of low water temperature during the offseason will be even more pronounced.

Availability of Steam

The third factor affecting operation is that of available steam pressure. Boosters can use steam pres-



3 EJECTORS SHOULD be designed for the highest available steam pressure to take advantage of the lower steam consumption resulting from higher pressure steam, as shown here

sures as low as 2 psig. For the secondaries, pressures of 35 psig or greater are required for economical operation. Since secondary steam requirements are seldom greater than 10 percent of the total steam requirement, it is apparent that low pressure or waste steam can be used. Where no high pressure steam is available, an electric driven pump may be used for air removal.

Steam consumption of both the boosters and the secondaries may be reduced by increasing the steam pressure. This does not mean that if a unit for low pressure steam has been selected for 2 psig, as an example, a decided decrease in steam consumption will result if the pressure is raised after installation. Ejectors must be designed for the highest available steam pressure to take advantage of the lower steam consumption resulting from higher pressure steam. The effect of steam pressure upon steam consumption is shown in Fig. 3

Many Applications

Equipment may be installed either indoors or outdoors, with ejectors either in the vertical or horizontal positions. Insulation is required for the evaporator and the first section of the jets only.

A very interesting aspect of steam vacuum refrigeration is its use in the direct cooling of various fluids by means of flash cooling. Many cooling applications involve fluids such as sugar solutions, coffee extract and fruit concentrates. In placing these fluids in the evaporator portion of a steam vacuum refrigeration system, they may be both concentrated and cooled at the same time. When corrosive gases must be cooled, and spray washers are used, it is a relatively simple matter to make the flash tank and nozzles corrosion resistant.

One installation involved the cooling of air for air conditioning. Corrosive process vapors used in another section of the plant had condensed on the wetted surface of the air conditioning cooling coils, corroding them out in less than a year. Subsequently these coils were replaced with air washers, resulting in carryover of corrosive materials to the evaporator. A simple coating of the flash tank was all that was required to adapt this system to the new corrosion problem.

Air Conditioning Applications

A large paint manufacturer has combined the use of readily available process steam with easily obtainable sea water in a two ejector system using a barometrie condenser. This plant has undergone an increase in capacity which required only minor equipment changes at slight cost. The use of excess steam capacity for summer cooling needs made steam vacuum refrigeration a natural for this installation.

A large industrial laboratory recently installed a 400 ton four booster fully automatic system for air conditioning. This plant is located adjacent to readily available sea water which is supplied to the barometric condenser. Since the water source has never exceeded 78 F, the steam vacuum system uses comparatively little steam for each ton of refrigeration. The steam vacuum refrigeration system was selected because of its low first cost, low maintenance and low operating cost.

One large food processor uses a 100 ton steam vacuum refrigerating system to chill water which is sprayed over vegetables to cool them before they are packed. The large overload capacity of the steam vacuum system is of prime importance since the vegetables often come to the cooler directly from the warm fields. Rapid cooling is essential in this application for top quality.

In recent years, the frozen juice concentrates industry has seen rapid expansion. Most of the frozen juice processed in the U. S. is flash concentrated and simultaneously cooled by steam vacuum refrigeration.

In these installations, the fruit juices must be concentrated by evaporation at a low temperature to avoid damage to the taste and destruction of the vitamins. Thus, the boiling point is lowered by maintaining a vacuum in the evaporator. The vapors which issue from the concentrating juices are entrained by the steam in the ejector. The exhaust steam which contains vapor plus motive steam is used to supply the heat required to produce the fruit concentrate. This application of the heat pump principle and the requirement for simultaneous concentration again are ideally suited to steam vacuum refrigeration.

To Simplify Packaging of Pipe Couplings

. . . recommendation offered

A PROPOSED Simplified Practice Recommendation for Packaging of Steel Pipe Couplings (Standard and Line Couplings, Black or Galvanized) has been submitted to manufacturers, distributors, and users for comment or acceptance, according to the Commodity Standards Division, Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C.

Purpose of the recommendation is to establish a simplified schedule of standard quantities per unit package for steel pipe couplings (standard and line, black or galvanized) ranging in size from ⅛ to 2 in.

Mimeographed copies of the proposed recommendation may be obtained from the Commodity Standards Division at the address given here.

Did Cars Like This Change Heating Practice?

I. W. Cotton, author of this article, says *"Yes"*

At a recent ASHVE summer meeting, a prominent British heating engineer was an interested attendant of the technical sessions. His observations were frequently invited and his spicy comments made him a popular as well as respected addition to any gathering.

Americans Chided

The time inevitably came for him to make the usual English remark chiding us Americans for our "tropical" indoor temperatures in winter. He crashed through in grand style, by asking the following question in concluding his remarks.

"Does your preference for such hothouse conditions indicate that you have entirely lost the ruggedness bequeathed you by Britain 350 years ago through the hardy Pilgrims?"

"Probably not," came a reply from an American. "Anyhow, you keep the ruggedness, and we'll keep our comfort."

This delighted the Briton, who was a good sport.

Why So Much More Warmth?

Some time later the subject came up again in an informal group enjoying shop talk after lunch.

"Would you really like to know why we maintain our homes and buildings at temperatures you call tropical and we consider comfortable?" inquired a midwesterner.

"I really would," replied the English engineer. "We like to rib you about it, but we seriously wonder why you prefer so much more warmth than we do.

"Continental Europeans tell us we keep our buildings all over England entirely too cool," he continued. "In fact, we have to agree that we maintain indoor temperatures several degrees cooler than those preferred by our own neighboring countries.

"The thing that interests us is that you like your rooms warmer than regular European practice, but hotter than ours. It is the degree of difference, rather than just the difference that intrigues us. I shall welcome your explanation."

"This will be just one man's opinion," replied the midwesterner. "I haven't discussed it with anybody, and I may or may not have the accord of my fellow Americans, but I have a positive conviction about it.

"Let me say first, though, that I think the marked difference in our preferences has come about fairly recently. Not too many years ago you could not have drawn much of a distinction between Continental practice and our own. Our preference for considerably warmer indoor conditions than yours, rather than just moderately warmer, has all come about since 1920.

"And my explanation of the cause is the closed automobile!"

Why the Closed Car?

Great Britain slowly shook his head.

"I don't get you, as you say over here. What has your closed car got to do with the way you heat your buildings?"

"Simply this. Most Americans today have closed autos. They travel about fully protected against the elements, and warmed by their car heaters. Except for those of us who work long hours outdoors, we have only short periods of exposure to the cold. We walk a few steps from our warm home to a warm car — or one which quickly becomes warm. From our warm car we walk a few steps or at most a few blocks to a warm building, and then back to a warm car and to a warm home again.

Everyone Dressed Warmer Then

"This situation did not exist prior to the advent of the heated, closed automobile. In the late horse and buggy days, and the days of the

earlier cars, everybody endured far greater exposure than now. People had to walk oftener and for greater distances; frequently they had to wait in the cold for street cars or interurbans. Naturally they had to dress with warm clothing.

"Woolen garments, beginning at the skin and working outward in layers, were required by just about all of us to keep from freezing. We couldn't very well change to lighter clothing every time we went indoors. We took off the heavy overcoat or the full length fur coat when stepping inside, but that left the snug thick underclothing and the comparatively heavy suit or dress.

"Of course, dressed that way, we didn't require very high indoor temperatures to be comfortable. Up to the early 1920's we probably maintained averages comparable to those in most of Europe. You would have considered them warmer than yours, but not considerably hotter.

"Our transition came about rapidly, as time is counted in considering significant changes in human customs. Actually there were comparatively few closed cars, percentagewise, in the early '20's, and very few car heaters. In the late '20's, very few cars weren't closed and very few didn't have heaters.

Lighter Clothing Advocated

"Along in the '20's one manufacturer courageously began ballyhooing the soothing and healthful advantages of wearing summer weight non-wool shorts the year 'round. Get rid of scratchy, clingy wool; let the body breathe, was his story. Carry less dead weight, move about freely and keep warm outdoors by walking briskly!

"Those Americans who then had closed cars and seldom had to stand still outdoors waiting for the streetcar, took up the idea.

"The manufacturer pioneering the idea probably thought to his dying day that he was responsible for changing America's winter clothing habits, little realizing that he had simply timed his innovation luckily. Warm homes and warm cars had prepared their possessors for this evolution — it certainly was not revolution. As more and more people bought closed cars, and lived in central heated homes, more and more naturally turned to the comfort of light clothing.

"Then came the next inevitable change, so gradual as to pass unnoticed in the process; realization came with the completion. Lighter clothing did not supply the insulation provided by the thick layers of wool. Thus, the 70 F at zero F outdoors considered sufficient previously, no longer would do.

"The heating engineer probably did not know why his customers now demanded more warmth, but he did know that he had to provide it to keep them satisfied.

Thermostat Setting Increased

"So he quietly developed the art of draftless heating to a science, and just as quietly shoved the thermostat up bit by bit, and as a result, 70 F at zero eased up to 72, then 74, and now to a generally accepted 75 F. The evolution was completed. America had substituted warm environments for warm clothes.

"I believe that the transition to light clothing would have taken place gradually, if at all, had it not been for the heated automobile. Instead of the custom being widespread, it probably would have been concentrated in the warmer latitudes.

"There it is, Mr. Great Britain, for whatever you consider it worth. It is my conviction in any case. Our mode of living previously required us to wear very warm clothes all winter; we wore woolens and we wore the underclothing indoors as well as out. We did not need indoor temperatures above 70 or 72 F. The doctors then said 68 F was ideal.

"Now we dress for summer all winter, and therefore heat our buildings to pleasant summer temperatures. And the closed car made the change possible.

"What do you think of my theory?"

British Conditions Unchanged

"It sounds plausible to me," said the Briton. "Good enough to take back to my associates as a sound reason.

"Your reminding me that your own temperature preferences have risen noticeably during the past quarter of a century further clarifies the question. Our English environmental conditions and also those on the Continent have remained practically unchanged. Ours were, and still are, cooler than the Continental; yours were comparable to the Continental, thus warmer than ours. Now yours are warmer than theirs and thus hotter than ours.

"I am reminded," he continued, "that your own native Benjamin Thompson, who became our Count Rumford, wrote a short essay on the subject of our cold rooms 150 years ago. You may remember that he invented the non-smoking fuel saving fireplace, also the common kitchen range, and he was the first scientist to recognize the fundamentals of heat and expound the theories to which we adhere to this day.

"Count Rumford spent many years on the European continent and pointed out in his 'Salubrity of Warm Rooms' that the Swedes and Russians dwelling in far colder winter climates than the English, fortified themselves against exposure to bitter chill outdoors by living in hot rooms indoors.

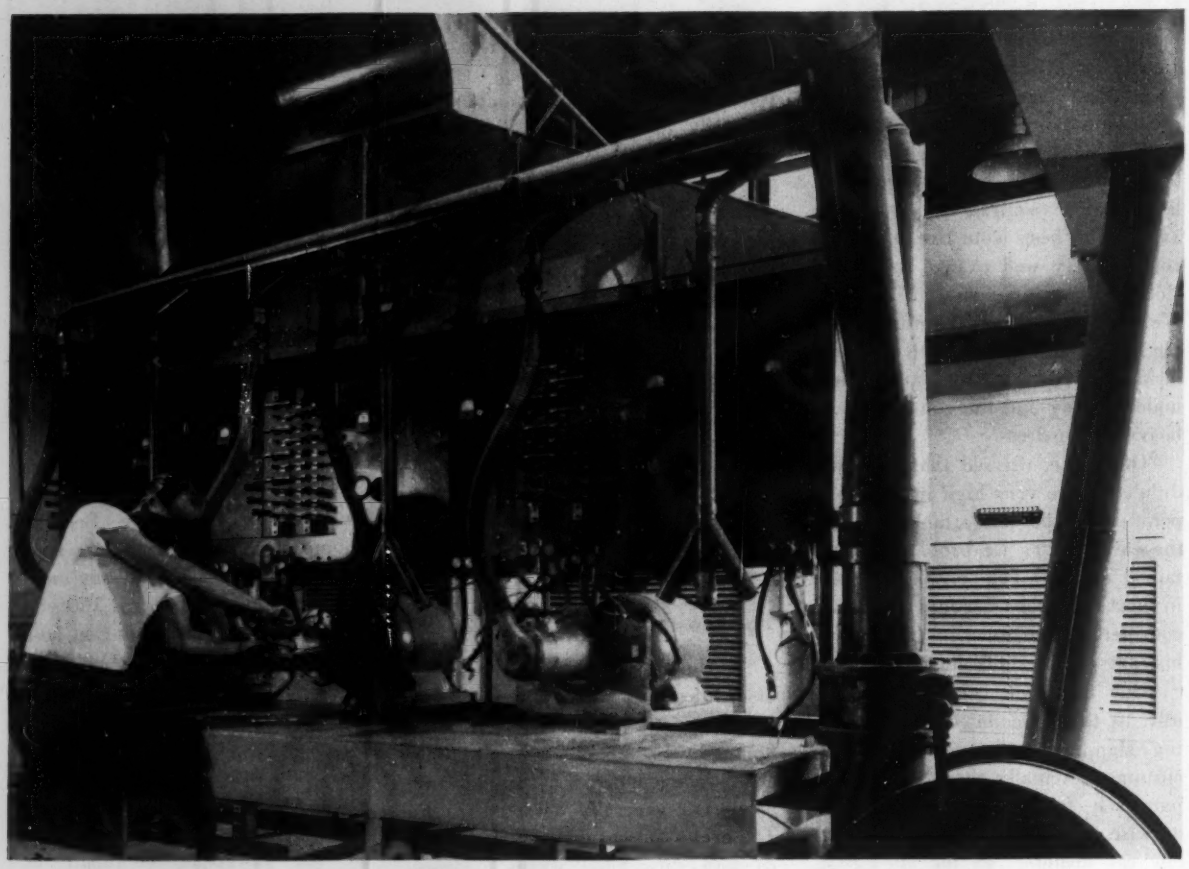
"So maybe you can poke as much fun at our frigidity as we do at your torridity."

He reflected a moment.

"At the risk of being considered a traitor by my fellow heating engineers in England, I must confess I rather like your warmer rooms in the midst of winter's chill, and also your lighter clothing all year 'round." He then concluded:

"All I will have to do to boost our indoor temperatures and inaugurate a clothing revolution back home is to see that the big number of the Britishers who now do not have closed cars, immediately get them!"

On which note that particular informal session broke up.



CONTROLLED TESTING conditions eliminate summer shutdowns after air conditioning units were installed to

Supply Cooling Air

. . . for testing generators and alternators

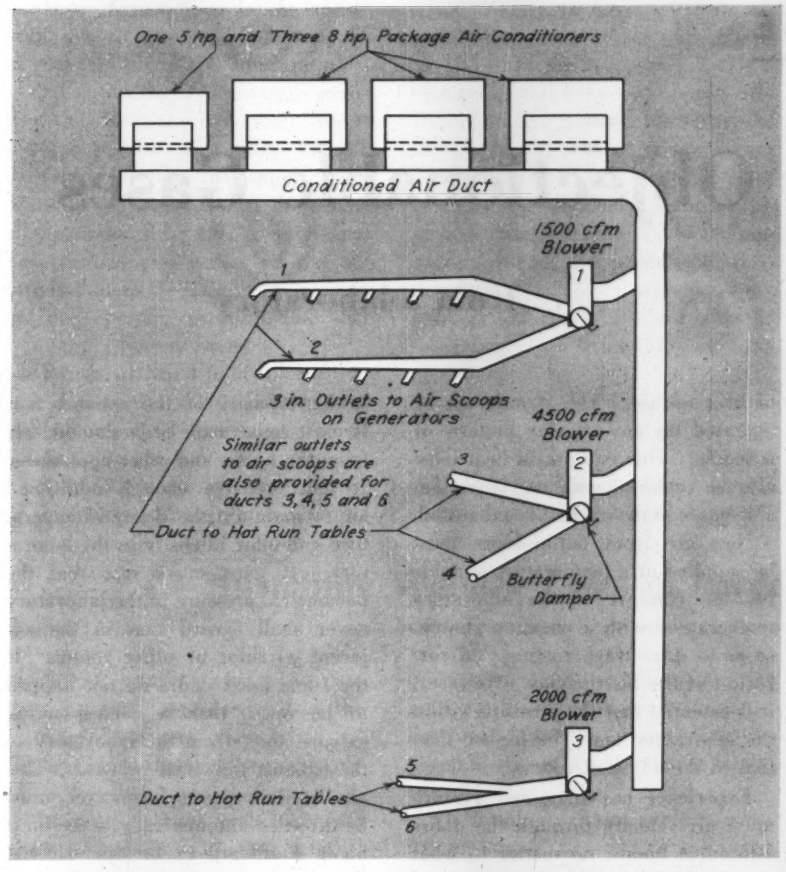
By A. F. Arnold

Works Engineer, Small Motor Div., Westinghouse Electric Corp.

AIR FORCE requirements call for cooling air to be supplied to the air scoop of each generator and alternator under test through a 3 in. diameter pipe at a total head of 5.8 to 6.0 in. of water, measured 15 in. from the air scoop intake. The temperature of the cooling air must be between 77 and 104 F, or 25 and 40 C, which is the reference scale in the electrical industry.

Air Supplied Direct to Units

Air is supplied directly to the units being tested on the hot run tables through a system of ducts and blowers ranging in capacity from 1500 to 4500 cfm, depending on the number being tested, in our plant at Lima, Ohio. The ductwork is so designed that the pressure at each unit can be controlled by a butterfly damper on the discharge of each blower. Filters of the disposable type are installed on the intake of each blower to remove excess dirt from the air.



COOLING AIR is supplied directly to the generators and alternators being tested on the hot run tables through a duct system especially designed to meet Air Force requirements

Before air conditioning was installed, it was found that the cooling air supplied to the generators during the summer months often reached a temperature of 122 F (50 C) or higher, necessitating the shutdown of test operations. This of course, resulted in increased costs and a loss in production.

In studying the methods of cooling the air to meet the testing specifications, two types of systems were analyzed. One of the methods involved passing the air over water cooled coils. The other was air conditioning by mechanical refrigeration.

To cool the volume of air needed in order to obtain the required temperatures by the first method, large quantities of cool water would have been required. Supplying this water would necessitate a large expenditure for well drilling or for enlarging the city water supply to meet the demand.

It was decided that air conditioning by mechanical refrigeration was the most practical and economical method. Two types of mechanical refrigeration were considered. One was a central system consisting of a compressor, cooling coils, filters and housing, and controls. The other was the package type of air conditioner complete with accessories and controls.

Packaged Units Chosen

A comparison of costs for this installation indicated that the package units were more economical, as the initial cost of the package units in this installation was only about 75 percent the cost of a central system. Also, the package units could be used individually for cooling small areas in the plant when they were not needed for testing the alternators and generators.

Three 8 hp and one 5 hp package air conditioners were installed with ductwork connecting the output of all four units in parallel. This duct extends and connects to the input of each blower which furnishes cooling air to the hot run tables.

Temperature controls installed in the conditioned air duct are adjusted so that each air conditioner operates at a slightly different temperature. The volume of air circulated over the cooling coils decreases when fewer blowers are operated. This decreases the temperature of air in the duct, which in turn shuts down the air conditioners one at a time, in order to maintain the desired temperature limits.

The installation has proven to be very satisfactory during the year that it has been in operation. No loss of time or production has occurred because of excess temperatures, even in the hottest weather.

Inspects 40 Year Old Ducts in Tokyo

. . . his firm installed

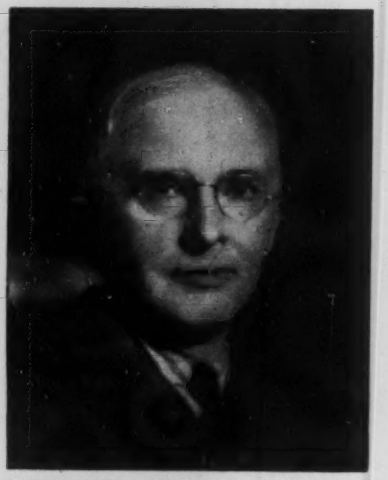
When Louis L. Narowetz, president of the Narowetz Heating & Ventilating Co., Chicago contractor, visited Japan last year, he had the opportunity to inspect the world famous Imperial hotel in Tokyo, designed by Frank Lloyd Wright and built some 40 years ago.

Mr. Narowetz' father supplied the duct work, fans and other ventilation for the hotel. Mr. Narowetz found the installation is still in good shape.

SAM LEWIS' PAGE

Removing Objectionable Gases

. . . from a laboratory



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. This month, he discusses his solution of a problem that he was called in to help correct — removing objectionable gases from a research laboratory.

A VARIETY of equipment in research laboratories, when operated, may emanate gases that, when in contact with the skin, or if respired, will be dangerous to the life of the occupants. Recently, I was called in to help solve the problem of removing such objectionable gases from a research laboratory.

Remove Equipment Heat, Too

Another problem that was found in this laboratory that is quite common, is that when some of the equipment is operated, it has a high rate of heat release. Yet, it may not be operated on any regular pattern or schedule. This equipment heat must also be removed with the objectionable gases in the air that is exhausted.

New air from out-of-doors must be supplied at a temperature suitable for the comfort of the laboratory workers and with a moisture content so as to discourage rusting and corrosion of the instruments. However, it is essential that the pressure within the laboratory never be higher than that in the adjacent rooms.

Experience has suggested a minimum air velocity through the doors into fume hoods, no matter to what degree these doors are open, of 150 fpm. There are available pressure sensitive controllers that when placed in the outlet duct of a fume hood, will automatically adjust a damper in the duct. If the fume hood door is opened only a little, the damper in the exhaust duct then opens only a small percentage of its ultimate position. On the other hand, if the fume hood door is opened wide, the damper in the exhaust duct in turn will be wide open.

Provide Make-Up Air

It is necessary, of course, to deliver a definite volume of previously conditioned air to the laboratory, sufficient in volume to replace all of the air that can be removed. It must be adequate in winter to deliver enough heat, and must be cool enough in the summer to remove the undesirable heat, not only from the equipment but also from the bodies of the workers.

One of the basic factors of success is the capacity of the exhaust fan. It must remove the objectionable air from the hoods and other appliances. It must remove enough additional air to maintain the desired temperature and odor intensity in the laboratory. It must make sure that the barometric pressure in the laboratory never shall exceed that in the adjacent corridor or other rooms. If the fume hood doors do not happen to be open, then a corresponding exhaust duct from the laboratory to the exhaust fan must be used. This auxiliary air passage, however, must be throttled automatically if the fume hood doors are to be opened, lest dangerous gases otherwise are allowed to escape into the laboratory through the fume hood doors.

Controls Govern Operation

A supply of make-up air is maintained in a room adjacent to the laboratory in a properly controlled condition, to the end that the air pressure in this room always exceeds the pressure in the laboratory. An opening is provided through the wall between the adjacent room and the laboratory, so that air may enter the laboratory from it but may not flow from the laboratory to the adjacent room. The automatic controls that are used in this installation are given below.

a) Control No. 1 is pressure sensitive, and is in the laboratory fume hood duct, to maintain the indispensable draft intensity through the fume hood door.

b) Control No. 2 is pressure sensitive, and is in the exhaust fan inlet duct to assure a minimum draft, re-

gardless of variations in the resistance due to changes in the supply of make-up air to the laboratory.

c) Control No. 3 is pressure sensitive, and is in the laboratory, limiting the volume of conditioned air delivered through the supply duct so as to prevent pressure in excess of that induced by the exhaust fans. This control also serves on the air supply duct to the adjacent room and on the opening through the wall from the adjacent room.

d) Control No. 4 is heat sensitive, and adjusts the valves on the heat transmitting fluid that serve the air conditioning coils. One pilot instrument (A) in the laboratory passes or fails to pass air to a second instrument (B) in the laboratory air supply duct. Instrument (A) reports to (B) that the laboratory needs a change in the temperature, but (B) refuses to bring about the change if the air flowing past it is warmer or colder than the predetermined limit of tolerance. A similar combination of instruments is provided in the laboratory, which are sensitive to relative humidity. They control an air reheater on the laboratory side of the refrigerated dehumidifying coils in summer.

Controls Fail Safe

I like this adaptation of pneumatic controls, especially when objectionable gases are to be handled, since any valve or damper can be arranged to assume one positive position by a spring, with compressed air in a cylinder actuating a piston to counteract the force of the spring. The amount of movement can be minutely adjusted and will repeat indefinitely, while if through any accident the supply of compressed air should be absent, the system will fail safe. Failing safe is a very desirable characteristic of any automatic controller. If a locomotive engineer fails to hold open the throttle, the engine fails safe and stops. Thus, this arrangement corresponds to the well known "dead man" switch.

Installing Window Units in Large Buildings

. . . building managers propose restrictions

RULES FOR installing window air conditioning units, recommended by the Building Managers Association of Chicago to its members, received no action by the National Association of Building Owners and Managers when brought up at the national group's annual convention in Denver.

The main recommendation of the Chicago BMA is that office building managers not permit tenants to install units that extend beyond the line of the window sash or that prohibit the operation of the window in its entire travel.

Other recommendations by the group's general operating and maintenance committee are that:

1) Tenants consult the office of the building before entering into any contracts or agreements for air conditioning.

2) Elevator operators secure written admission slips from the office of the building before permitting any air conditioning unit to be brought into the building.

3) The tenant bear the cost of extending the necessary new electrical circuits needed for the installation of his own air conditioning units, regardless of size or type.

4) Tenants not be permitted to install a water cooled unit until a thorough survey is made of the requirements, and arrangements are made for bringing in a separate water line and drain with due regard to the possible overtaxing of existing facilities.

5) Building will not agree to service or repair any air conditioning units, and that this be made clear.

6) Building will not agree to store units during the winter — but should suggest to tenants that the firms that install units usually have facilities for storage.

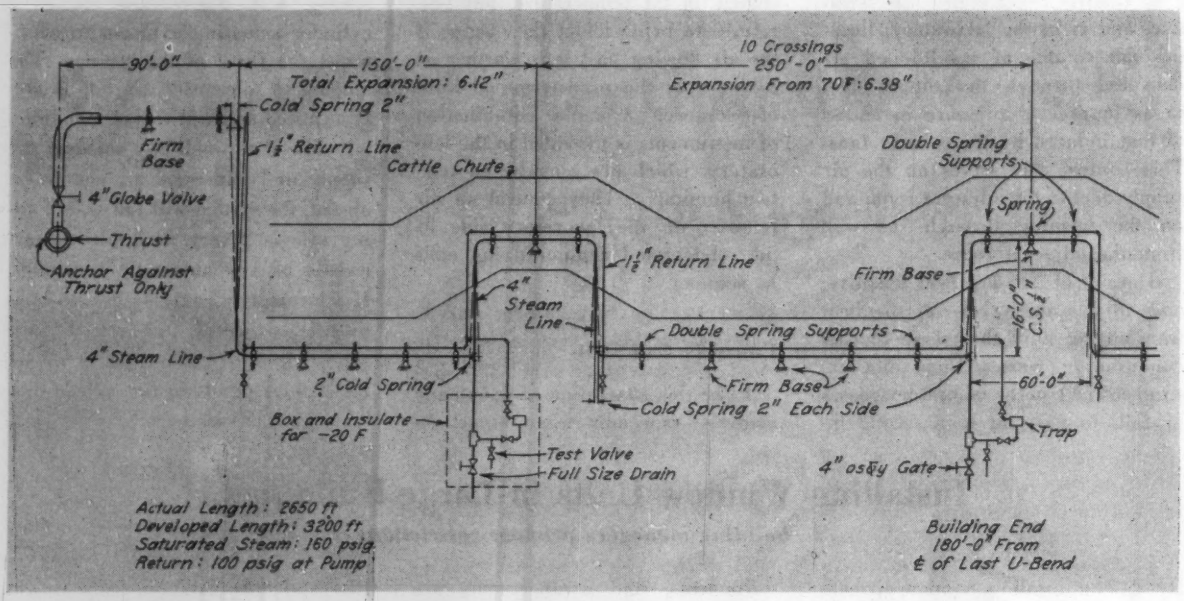
The committee is contacting air conditioning unit manufacturers to promote these recommendations and the development of window units that will be "less bulky" than the present models.

The chairman of the committee, in a letter to the members, stated that "we have been informed by several manufacturers that they can install units allowing free travel of the window and that they do have such installations available for inspection."

There are many factors to be considered, says the committee. Several of these have been isolated as problems stemming from unregulated installations of window units. Besides those of interference with free travel of the window, overloading of electrical circuits, and winter storage are those of adequate support, weight distribution, water exchange, dripping, accessibility for servicing, nuisance factors, and defacing the appearance of the building.

In one city, where window washers have refused to work where window units are installed, because of lack of footing, strict rules for installation are in force. In another city, window units interfered with scaffolds used by tuck-pointers.

In Chicago, the city's department for the inspection of steam boilers, unfired pressure vessels, and cooling plants only recently issued four safety regulations on installing window type air conditioners. They require that the center of gravity of the unit be inside the building; that the unit not extend over the building line or the sidewalk unless the unit is at least 8 ft above ground level; that the unit not be located in transoms unless weight-safe and anchored; and that the unit not be so located as to create a nuisance to other tenants or neighbors. "In all other respects, window model air conditioning units employing a mechanical refrigerating system for cooling purposes must be constructed and installed to conform with chapter 85 of the Chicago municipal code," according to these rules.



INVERTED U BENDS in the 4 in. half mile steam heating line are to be used for crossing the streets. Expansion and drainage are thus accomplished, showing that

Pipe Bends Can Serve

. . . a double purpose

By Bill Dopp

• Bill Dopp has had some 40 years of experience dealing with piping, including a long stretch of service as a sales engineer. He is devoting part of his present leisure to drawing on his many piping experiences.

This month, Mr. Dopp's principal character, Martin MacVane, reviews the plans of one of his friends for piping steam over half a mile in a 4 in. line. He discusses the dual use that pipe bends can serve along with the provisions for supporting the piping and its operation.

MARTIN MACVANE enjoyed visiting with Mr. Gale, head of the family operated Superior Packing Co. The old gentleman had seen a lot of life but still maintained a keen progressive outlook, always ready to try new things if they looked economically sound. Mac showed no surprise when Mr. Gale — nobody would think of calling him anything but Mr. Gale — told him that they had bought the Webster building for an office. "You see, Mac, we've got to have more space. By moving the office away from the plant, we gain two things, more space here and easier access to town for the office operations. It's getting more and more difficult to get office help to come out here."

All of the names in this article are fictitious.

"I guess it's getting more difficult to get help," laughed Mac. "I understand that the Webster estate hasn't been able to do much with the old building, because they have no way to heat it, since the Polk people stopped selling steam to them. How are you going to keep your people warm?"

Pipe Steam Half a Mile

"We're going to heat it from here, Mac," Mr. Gale replied.

"That must be over half a mile away," declared Mac. "Are you going underground?" Mac asked, in showing his astonishment.

"No," the old man smiled broadly. "We hired a new engineer some time ago. He is a man of considerable experience, David Cooper. Came from the Spencer Co. Perhaps you know him."

"I've known Dave Cooper ever since he got out of school. If you take his advice, you can't go far wrong." Mac's endorsement of his friend had the ring of sincere admiration.

"Mr. Cooper contends that it will be far more economical to run a steam line from our plant here than to rebuild the Webster block so that we could produce the necessary steam on the premises. We'd have to rebuild about half the old place to do it." Mr. Gale paused to press the button on his desk and to direct the young lady who answered it to bring him the drawings of the new steam line. "Cooper has laid out a scheme for getting the steam over there that would cost a lot of money, but I agree it would be cheaper in the long run, if it will work." He spread the drawings out before him on the desk, saying, "I wish you would look at this layout and tell me what you think of it." A strange look of surprise spread over his face as he looked up to see Mac shaking his head.

"You'll pardon me, I know, Mr. Gale, but I wouldn't want to do that without Dave being present. I'm sure that you'll understand." The old man grinned at Mac, nodding.

Cattle Chute to Support Piping

"Right you are," he said, pushing the button again. "Miss Morgan, please find Mr. Cooper and ask him to come in here." He turned back to the drawings. "Cooper wants to take advantage of the fact that we have a right of way for our cattle chute over to the other rail line. It passes about a hundred and seventy feet from the Webster building, but it actually touches the property at one point for about thirty feet. He intends to use the chute as a support for his line most of the way. See here, he would tie into the auxiliary header near the end, cutting straight through this wall to where the line would cross the chute at about fifteen degrees. Then he would drop down to ground level and follow the chute all the way across town to the other building." He straightened up as there was a tap on the doorframe. "Come in, Mr. Cooper. You know Mr. MacVane?"

"You bet I do. Hello, Mac! I'm glad to see you. How's everything?"

"Just fine, thanks," replied Mac, "It's like old times to see you. You're looking healthy. I see you've been working, too. Mr. Gale has just explained to me how you propose to heat that old Webster building. You've taken on a job, all right."

"It's not as bad as it looks at first, Mac. Mr. Gale isn't quite sure that I'm right, though," said Dave smiling. "There's a couple of things that I'd like to ask you about too."

"Mac wouldn't express an opinion about your work unless you were here," commented Mr. Gale. "Now, I'm going to ask him to tear it apart. Okay, Mac?"

"It isn't as rough as that, Dave," said Mac. "Let's see what this is all about. Mr. Gale left me stranded at the cattle chute. Where do we go from there?"

Cross Streets with U Bends

"Right along the chute on rollers supported on concrete piers. When we get to the first street, we cross it with a big inverted U bend. Here's where we get two functions out of one bend. It puts us across the street and takes care of the expansion at the same time. There are ten of these crossings that we have to jump in the twenty-six hundred feet we have to go." Dave pointed to the bend layout. "It presents a nice problem in drainage, too."

"You've worked out a neat drainage scheme here," observed Mac. "What are you going to do with the water?"

"Pipe it to the storm sewer," declared Dave, grinning and winking at Mr. Gale. "We found something in the old franchise with the city that really helped us with a lot of problems." Dave was obviously pleased. "There is a clause that permits us to run pipes, wires or beams across these streets as well as the chutes, so long as we keep everything twenty-two feet, six inches above the street level. The chute is just that for a width of thirty-six feet, then the ramps slope down to the runways which are about eight feet above the ground. Drainage from the chute must be carried to the storm sewer. By stretching a point, this gives us a chance to get rid of our initial condensation, as well as the drainage from the line while it is in operation."

4 in. Valve for Drainage

"Dave insists that he has to have a four inch valve at every one of those risers," said Mr. Gale. "I don't want to be penny wise, but don't you think that a smaller valve would do just as well?"

"No," answered Mac, "I think that Dave is right there. You want to get rid of the initial condensation as rapidly as possible. You must avoid any chance of creating water hammer. This layout is perfect for that." He smiled at Dave and asked, "I take it that you intend to spin open your main valve?"

"That's another point upon which we don't agree," observed Mr. Gale. "I don't see how you can do that without taking a chance of wrecking the entire line."

"What's your theory, Dave?" asked Mac.

"The way I look at it is this," replied Dave. "If you use a smaller valve for heating up the line, you will be forever and a day getting this line into service. There will still be the same amount of condensate and the same movement due to expansion. Now, if you spin open the main valve you will let hot steam into the line, condensing it rapidly. The pipe will heat rapidly, too. The steam will push the water ahead of it to the first drop and down to the first drain valve, where it will be eliminated. We will keep all of these four inch valves wide open. As soon as fairly dry steam shows up we can be sure that the line up to that point is nearly at the right temperature. Then, we close the big valve and let the trap take over. So we go on from one to the other of these drainage points until the entire line is hot and under pressure." Dave had been following the line on the drawing with his pencil. He looked up at Mac for approval, but Mr. Gale interrupted.

"Dave's got the whole thing figured out, as you can see, Mac. The question is, will it work?"

"I'd say that it is the only way to put this line into service, Mr. Gale. The design has been set up for that. If you had smaller valves at the drainage points, it would take much longer to heat the line. With such a rapid rate of condensation, you would almost certainly run into water hammer. This way, that should be avoided completely."

What About Expansion?

Dave tried to suppress a grin of satisfaction at Mac's indorsement of his plan. The gasket salesman's next question brought him up short. "How about this matter of expansion, Dave?" asked Mac. "What happens when this line begins to crawl?"

"I've figured the expansion as though the line would be at the maximum temperature of 160 pound steam all of the time it is in service. If we anchor the line halfway between the bends, there will be a total of two hundred and fifty ft expansion to take care of at each street. By using these inverted U bends, leaving the tangents free on spring supports, the stresses in the bends will be so low that the expansion is no problem at all." Dave pointed to the top of a U bend. "I figure that the way to support the top of these bends is to put brackets on the chute, using spring supports that have rollers and springs both on the top and bottom of the rolls, for the end supports. That way, the pipe would always be resting on springs. The center support of the bend would be set, so that when it is cold, the pipe would have a solid support that would keep it from sagging. In this way, the bend would always drain."

"How did you figure those stresses?" inquired Mac.

"I used the 1953 edition of Wert and Smith. I've found the charts in this book to be pretty good, and you don't drown in figures getting your results. I've checked the answers several times, to be sure they are right." Dave chuckled. "Just for the fun of it, I figured the risers as cantilever beams at ten thousand pounds of stress. Even on that basis, the available expansion is more than enough."

"You're going to pull the bends cold, no doubt?" asked Mac.

"You bet, at least fifty percent of the expansion. Since the line will be entirely welded, we won't have to worry about the pipe joints during the summer." Dave seemed to be feeling completely sure of himself by this time.

How Is Line to be Used?

"You fellows are ganging up on me," laughingly complained Mr. Gale. "Now tell Mac how you propose to use this line, Dave." Clearly, he wanted even more assurance.

"Under maximum load conditions, we may need about fifteen thousand pounds of steam at the Webster block. We carry a hundred and sixty pounds on this header in the power house. We will not need more than fifteen pounds for our heating system, so I'm planning to use this line as somewhat of a reducing valve. The pressure drop under full load would be about ninety pounds. At the normal load of about ten thousand pounds per hour, there will be plenty of pressure and some to spare.

"I'll put deadend regulators on the building header, set to give me the pressure I need to get the steam up to the various floors and for the domestic hot water heater. Fortunately, that's a two pipe system, so I can carry the returns down to a receiver." Dave paused, looking thoughtfully across the room. "Mac," he said, slowly, "what do you think of piping that return back to the power house? I'd have to use a one and a half inch line that would have to be covered like the steam line. What do you think? I've been toying with the idea of putting both lines into the same covering."

"Then you would be in trouble," quickly declared Mac. "Think a minute of what that combination would mean. The steam line loses temperature as it gets away from the power house. You will have one hundred and sixty pound steam at the start, with a temperature of what?

"Three hundred and seventy degrees," answered Dave.

"And at the other end, about seventy pounds at about three hundred fifteen. Now, your water will be less than two hundred twelve degrees to start with. It will continue to get colder, as it nears the other end. You'd be trying to hold two pipes inside the same covering, with one a good deal colder than the other is. In that case, what do you do when you get to the U bends?"

Both Dave and Mr. Gale were laughing. "Forget it, Mac. I should have known better," declared Dave. "Under normal load, there will be about twelve hundred gallons of water per hour, and when it's real cold, maybe as much as eighteen hundred gallons. We buy our water."

"Then, there is the only answer to your question," asserted Mac. "The water saving would pay for that line, pump and power in one season, I'm sure. Better plan on a separate line, though. You can use the same supports, but not the same covering. Why not cut your steam line trap returns back into that return line?"

"That's a thought. It will only work part of the way though, because we will have to use about a hundred pounds pressure to get the return back to the power house. Under a heavy load, about a third of the steam line will be below that. It will help to keep the temperature of the return line up near the far end." Dave seemed pleased with the idea.

Use Double Pipe Rollers

"Watch out for your pipe connections," warned Mac. "Don't let anything get rigid. By the way, what's the need of anchors on that steam line?"

"Why — to force the expansion into the U bends." Dave sensed a catch in Mac's question, showing reluctance to answer it.

"I don't think that you need them," declared Mac. "Put double rollers on your supports to hold the pipe in place, and let the line find its own balance. If you don't try to hold it, you will have a line with equal stresses along long sections of it. You realize that the expansion won't be uniform anyway, since the pressure is constantly falling along the line, and the temperature is doing the same thing. If the first U bend is flexible enough, then all of the others will be, too. There may be a time when all the load is shut off. Then the whole line will come up to a hundred and sixty pounds, and it will all be at maximum temperature."

"No it won't, Mac. I've got that fixed." Dave showed delight at having beat Mac to the punch. "There will be a pop valve at the far end of the line set at a hundred pounds, and relief valves will be on all of the regulator outlets. These will be deadend regulators, of course. Should one stick, the relief will protect the equipment, but I'm not taking any chances of getting a high pressure on that heating system. Next to that main pop valve, there will be a pressure switch which will be set about five pounds lower than the pop. If pressure builds up, it will sound an alarm in the power house so that the main globe valve can be temporarily throttled. I'm going to run that wire inside the covering of the steam pipe, too," he finished, grinning.

"That's okay with me," laughed Mac. "I guess that about covers the ground."

Is It Safe Without Anchors?

"I wonder if it is safe to install that line without any anchors, Mac?" asked Mr. Gale.

"It's a first principle never to try to hold down a pipe that is likely to change in temperature, unless there is danger of its going in the wrong direction. If this line is properly guided on rollers, so that it won't tend to buckle, and so that it is left free to find its own stress balance, you will never have any trouble with it." Mac started to chuckle. "I once laid out a line for a heating job, leaving it free, as I've suggested. However, someone thought that I had made a mistake, so without saying anything, he put in a fine anchor near the middle. It happened to be at the point of maximum movement. When the steam was turned on, the expansion finally built up a load that sheared four inch and a quarter bolts, scaring the daylights out of the erecting crew."

"Did it break the line?" asked Dave curiously.

"Fortunately, it did little damage other than to the anchor," said Mac. "Always keep in mind the fact that nature will have her way. You can guide her into the channels that you want her to follow, but go she will. Nothing can stop the movement of material due to expansion or contraction caused by changes in temperature."

"Most of us have learned that the hard way," observed Mr. Gale. "You think that these bends will take care of this line, Mac?"

"They certainly will. Unrestrained U bends tend to take the shape of what has been called a double offset expansion U bend, when subjected to compression from the ends. It's the same story about balancing stresses. So long as the structure is uniform in strength, nature will take care of the distribution. If there is a weak spot though, it will quickly find that spot and concentrate the stresses at that point. Then, there is trouble." Mac stood up, getting ready to leave.

"It's fine to have a chance to talk these problems over with someone who has had firsthand experience along these lines," said Dave. "I'm more certain than ever that this line is going to work satisfactorily and pay off. I'm certainly going to adopt your suggestions, Mac, and thanks a lot."

"I'll add my thanks to that too, Mac," said Mr. Gale. "Come in and see us again, soon."

"Let me know when you put this baby into service, I'd like to be around."

"We'll see that you are," declared both of his friends, as Mac departed.

New Air Conditioned Office Building

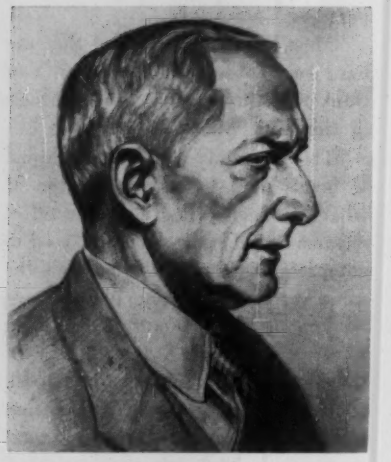
. . . construction begun

CONSTRUCTION has been started on the new home office building of the Connecticut General Life Insurance Co. of Hartford on 268 acres in suburban Bloomfield. The company estimates that the building will provide more than 500,000 sq ft of office space, and it will cost $10 million.

The new building will be a low, horizontal structure, most of which will be three stories in height. More than half the wall surfaces will be of heat absorbent glass and the rest largely of porcelain-enameled steel. The interior of the building will be largely without permanent partitions. Office areas will be divided for the most part by movable colored screens. The building will be completely air conditioned.

Architects for the new building are Skidmore, Owings & Merrill, and it is being built by the Turner Construction Co.

Avoid Mechanics' Lien Loopholes



WILLIAM HURD HILLYER, author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background. This month he discusses currently pertinent mechanics' lien angles for the contractor.

NO ASPECT of the building equipment domain is more important to the heating, piping and air conditioning industry than that of mechanics' liens — yet none is more mystery-clouded. "File a mechanics' lien!" sounds like so simple a formula that it is often lightly invoked and ill worked out. There are many loopholes that should be avoided in using it.

The heating, piping and air conditioning contractor is peculiarly at the mercy of lien technicalities because he is usually a subcontractor. Therefore, he occupies a complex position. The situation is further involved by time, a basic dimension of mechanics' liens. Although volumes could be written on the subject, the following little known principles are salient for guidance.

Contract is a Chart

When a construction contract is filed according to the mechanics' lien law, it serves as a chart by which all subsidiary parties at interest "adjust their obligations and shape their course." Material men and laborers are entitled to assume that no installment will be paid to the contractor until it becomes due and payable under terms of the contract. They can rely implicitly upon the "schedule" in the contract, which is an integral part thereof. On the other hand, the owner is not liable under "stop notice" if he has made payments to the general contractor ahead of contract terms and owed no money to the contractor when the notice was served.

Where an unpaid balance under a construction contract remains, the owner's claim, if he expends money to complete the structure following default of the general contractor, is superior to that of "stop notice" claimants, such as subcontractors. A case under this head is Barmiday Heating and Air Conditioning, Inc., who was a subcontractor on a building job which the Addem Construction Corp., the general contractor, failed to finish. (All names are imaginary.)

Barmiday Files "Stop Notice"

Barmiday filed a "stop notice" under mechanics' lien law for an alleged unpaid balance of $1495, covering equipment that he had installed. Before Addem abandoned the building, the owner had advanced sundry payments on the architect's certificate, the amount and legal effect of which were in dispute. This fact had a pertinent bearing on the sum — if any — remaining in the owner's hands and, consequently, on the amount available to Barmiday.

Barmiday's position was weakened by his claim of the full balance on his subcontract, although he admitted that at the time he filed the "stop notice" only $1073 was due him. He asserted he was suing for the full $1495 because he had men available to finish the job and had bought materials "which were hard items to dispose of." These, he said, would "probably lay" in his shop "quite a while" before he could get rid of them. He affirmed that because of advance payments to others, regardless of the contract schedule, the owner was chargeable with "additional monies" more than sufficient to satisfy his own claim.

The heating and air conditioning concern, after losing the case, appealed and gained a new trial. The higher court, though finding the owner not chargeable, thought Barmiday's claim should have been factually thrashed out by a jury. Had he not overreached himself and introduced ambiguities, he might have fared better from the outset.

Owner's Claim Rules

If there is an unpaid balance under a construction contract, the claim of the owner, who has spent money to complete the work after the contractor's default as in the previous case, is superior to that of mechanics' lien "stop notice" claimants. However, such claimants are entitled to hold the owner responsible for advance payments made to the contractor before service of "stop notice."

A recent case illustrates this principle. Fee-Simple & Co. entered into a general contract with Artifex & Son for the erection of a structure to be paid for in installments, plus a final payment upon the architect's certificate.

Artifex purchased material necessities from E. Quip & Co., to whom he still owed a balance after deducting payments and credits on account. Unable to collect from the general contractor, E. Quip filed a "stop notice" in the county clerk's office directed to Fee-Simple, claiming the sum of $2462 "for materials furnished". He demanded the retention of that sum out of any money due or to become due from Fee-Simple as the owner.

Meanwhile, the general contractor had abandoned the work. Fee-Simple & Co. averred that they had expended, in completing the structure, all but $900 of the sum remaining in their hands and that this disbursement was made in good faith fully five months before E. Quip filed.

The trial court held that (a) the payments made by Fee-Simple in order to finish the building were not "advance" payments; (b) the owners were entitled to credit, therefore, in ascertaining the sum in their hands at time of "stop notice" filing, plus a further credit of $750 for reasonable completion cost. This left only $150 in the owner's hands, subject to E. Quip & Co.'s claim.

Both E. Quip & Co. and Fee-Simple appealed to the superior court. The higher tribunal, reversing in part and affirming in part the lower court's judgment, awarded Fee-Simple $750 as "completion" money. Thus, E. Quip & Co. got only $250 out of their $2462 claim. Had Quip been more diligent in filing, he might have salvaged the whole amount by getting ahead of Fee-Simple's completion expenditures.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

QUESTION OF THE MONTH

Is Air Conditioning Worth the Investment?

I HAVE BEEN following with great interest the answers and other information published in HPAC on the subject of how valuable air conditioning is in boosting office efficiency and in justifying the investment in air conditioning. I would like to add to this, citing the results of some studies conducted in England in which the accident rate was measured with reference to variation in temperature conditions.

It is known that the proper control of indoor atmosphere results in improved comfort, increased efficiency in work and lowered accident and illness rates. Discussion of the methods by which the human body maintains its heat balance will seem more to the point if we present some of the concrete evidence on the effects of non-optimal environments. Studies of accident rates in relation to temperature are particularly interesting. Accidents are the result of faulty coordination or lack of alertness. In this sense, many clerical, computation and reading errors are merely psycho-physiological accidents in which the physical result is not injurious or alarming.

Convincing evidence is available to show the effect of non-optimal thermal environment on accident rates in at least three classes of work.

a) *Moderate to Heavy Manual Labor.* Investigators[1] have shown that the accident rate among mine workers bears a direct relation to temperature. Accidents were at a minimum when the air temperature was 60 F. However, the accident rate increased two and three times when the temperatures were above 80 F.

b) *Light Manual Work Involving Manual Dexterity.* Studies[2] conducted in British munitions factories show that both cold and heat stress increase the frequency of accidents in manual operations concerned with shell manufacture. Accidents were at a minimum when the air temperature was 67 F, and they increased when the temperature was above and below 67 F. The 35 percent increase in accidents observed when the air temperature was 50 F may be attributed to the reduction in manual dexterity. The 35 to 40 percent increase that also accompanied the higher temperatures — 75 to 85 F — may be attributed to decreases in general alertness and to increased physiological stress of discomfort due to heat.

c) *Practiced Habits of a Skilled*

[1]The Relation of Atmospheric Conditions to the Working Capacity and Accident Rate of Miners, H. M. Vernon, T. Bedford and A. G. Warner, Industrial Fatigue Research Board, London, 1927.

[2]Two Contributions to the Study of Accident Causation, E. E. Osborne and H. M. Vernon, Industrial Fatigue Research Board, London, 1922.

Worker Involving Minimum Physical Exertion. N. H. Mackworth[3] has shown that with wireless operators during long periods of reception, errors increased from an average of 12 per hr to more than 90 per hr as the effective temperature increased from 79 to 97 F. In the sense that errors in skilled acts are accidents, such data is convincing evidence of the deleterious effect of heat stress on human adjustment. — DR L. P. HERRINGTON, Director of Research, John B. Pierce Foundation Laboratory of Hygiene.

[3]Effects of Heat on Wireless Operators, N. H. Mackworth, British Journal of Industrial Medicine, 1946.

W. E. REYNOLDS —

"Break-Even Point at Seven Minutes"

I AM very much interested in the subject of justifying the investment of air conditioning in government buildings. I have found, through a study which was conducted in 1950, that for government offices, air conditioning costs about $45 per person for the installation and operation of the equipment. This would probably be up to $55 today. This represents only 1½ percent of the average salary of government employees. In terms of worker time, it represents seven minutes as there are 480 minutes in each work day; 1½ percent of this is seven minutes.

Therefore, if air conditioning encourages people to produce seven minutes of additional or more productive work per day, an employer can consider that he will break even on the extra cost of installing and operating the air conditioning equipment. — W. E. REYNOLDS, former Commissioner of Public Buildings, General Services Administration.

Other Information on the Subject Cited

OTHER information on this subject has appeared in the article, *It Pays to Keep Cool*, in the October 1939 HPAC. This article is a report of an efficiency study made by the Detroit Edison Co. in a drafting room operation several years ago. A definite unit of work was chosen for the test — one which would serve as a fair indicator — and figures were kept during June, July and August of 1937 and 1938. During the summer of 1937, in offices without air conditioning, 8988 work units required 5008 man-hours. During the summer of 1938, in the new air conditioned service building, 10,474 work units required only 3872 man-hours — an increase in efficiency of 51.4 percent.

Furthermore, this article reports that the total operating and maintenance costs for the new service building — based on net area and corrected for the difference in the size of the building — were 39.7 percent lower than those in the company's general office building, figured for the last six months of 1938. Labor costs were 40.2 percent lower, steam costs 62.8 percent lower and cleaning costs 42.7 percent lower. Electricity costs were only 1.6 percent higher although the light intensity was twice that in the general office building. Electricity costs include the power for all air conditioning equipment.

Another article that covers this subject appeared in the February 1952 HPAC, *How To Justify an Air Conditioning Investment*, by Peter J. Marschall. This article describes what factors were considered and the decisions reached before and after air conditioning was installed in the Abbott Laboratories. The author figured that an increase of 4 percent in productivity would pay for the investment. Operating experience after the system was installed is covered along with suggestions for planning the installation.

Another article on the subject of worker efficiency, *Why Precision Manufacturing Plants Are Air Conditioned*, by S. M. Miner, appeared in the July 1952 HPAC. Several specific quotations and references are given in which increased productivity and reduced absenteeism were found.

A second article by Mr. Miner, in the December 1952 HPAC, *Industrial Air Conditioning*, covers the points in justifying the investment on an economic basis. Also, actual experience data is given for several plants before and after air conditioning was installed and put into operation.

Other references that may prove to be of interest are:

a) *When Is Complete Air Conditioning of the Modern Factory Advisable?*, H. A. Mosher, June 1945 HPAC.

b) *Should Factories be Air Conditioned?* R. D. Tutt, W. E. Goohs and F. G. Tykle, January 1945 HPAC.

c) *How Much Does Air Conditioning Boost Office Efficiency?* November 1953 HPAC.

READER ASKS —

How To Ventilate Large Cafeteria Kitchen?

An extensive and complete ventilating system was installed when a modern cafeteria was built three years ago, but the 41 burners in the kitchen, when operating, proved to be too much for the system. The temperature in the kitchen is unbearable for the four cooks, bakery personnel and other occupants.

What is the best approach in revising an existing ventilating system in a cafeteria kitchen so that it will perform satisfactorily? I would like to use refrigerated spot cooling to help solve this problem, but it would take many tons of refrigeration capacity to remove the burner heat alone. There must be some more practical method than this.

I would appreciate seeing how other HPAC readers have attacked similar problems.—F.S.

[You are invited to comment on this question, giving actual examples if possible. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.]

Check Your Boilers Now

. . . if it hasn't been done yet

DURING a normal heating season, the average steam or hot water heating boiler is subjected to a wide range of expansion and contraction stresses due to the varying heat demands and consequently, an intermittent rate of firing, according to W. B. Parker, Assist. Chief Engineer of the Boiler Div. of The Hartford Steam Boiler Inspection and Insurance Co.

Nine Points to Watch For

The points that should be observed in the care of a cast iron boiler at the end of the heating season are:

1 Clean all boiler surfaces, firebox, ash pit, breeching and ducts to prevent corrosion.

2 Keep the boiler room dry and clean, taking care that debris and ashes are not allowed to accumulate around the boiler or piping.

3 Examine boiler for signs of rust growth between sections, and check the tie rods on push nipple boilers to determine that the nuts have been backed off several turns, or that the rods are provided with split nuts or compression washers.

4 Keep the boiler full of water during the idle season to prevent corrosion. This also protects possibility of a fire being started in a dry boiler.

5 Replace any cracked or warped cleanout doors. Also, check for air leaks at cleanout openings and at the breeching for greater operating economy.

6 Examine all piping, joints and fittings for corrosion and leaks, paying particular attention to the return piping.

7 Service all operating and protective controls during the idle season. This includes the safety valves, the low water fuel cutout and emergency water feeder, the pressure control, the fuel burner and all operating controls.

8 Do not use idle cast iron boilers as incinerators.

9 Contact an insurance inspector for his advice if repairs are necessary.

There is a strong inclination to forget about the heating plant when the weather becomes warm enough to shut down the boiler. There are several reasons why a complete check of the heating system is in order at the end of the heating season. Deterioration of the boiler and system may be much more rapid during the idle period than when it is in service. Also, if there is not adequate provision for expansion between the sections, serious damage may result while the boiler is idle or when it is started up in the fall.

Preventing Corrosion

An accumulation of soot and ashes left in a boiler often results in rapid deterioration by corrosion. Most fuels contain, among other impurities, some sulphur, a certain percentage of which will remain in the soot and ashes which accumulate on boiler surfaces. During idle periods, the soot and ashes may become moist as a result of absorbing moisture from damp air in the boiler room. Under such conditions, the sulphur combines with the moisture to form sulphurous acid, which causes serious corrosion of metal surfaces.

To prevent corrosion, all metal surfaces should be thoroughly cleaned at the end of the heating season. When the unit is clean, the chance of acids forming is reduced greatly and the boiler surfaces will remain dry. Where the boiler room is damp, the boiler surfaces should be painted with a protective coating, or the dampness in the room should be removed.

Trash and debris should not be allowed to lie around the boiler. Such an accumulation may corrode the metal supports for the boiler, resulting in movement or shifting of the sections.

Expansion Between Sections

After soot and ashes have been removed from boilers of the push nipple type, a careful examination should be made to determine if there is ample provision for expansion between the sections. Tie rods may have been incorrectly installed so that they hold the sections too tight, or there may be serious buildup of rust between the sections. Either condition may result in cracking.

If the tie rods of a push nipple boiler are installed properly, one of the following alter-

nate procedures should be used after the sections are assembled:

a) The solid nuts on the tie rods used for drawing the sections together should be backed off several turns to allow room for expansion, or

b) The solid nuts should be used in conjunction with compression washers, or

c) Split nuts should be used instead of solid nuts.

Internal Cleaning

If it has been necessary to add make-up water to the boiler during the heating season, or if the condition of the water in the gage glass indicates that the boiler water has foreign material in it, the boiler should be drained and flushed. This can be done by removing the plugs in the front and rear sections and washing the boiler through these connections. Washing in this manner will normally remove any sludge or loose scale. However, if the scale has baked hard to the internal surfaces, the boiler should be chemically cleaned by a reliable and experienced company.

Leave Idle Boilers Filled

All idle cast iron boilers will deteriorate less during idle periods if completely filled with water. Steam boilers should be filled at least to the top of the water gage glass or preferably up to the steam outlet connection. The boiler and system in hot water heating plants should be left entirely filled. Leaving the boiler entirely filled with water will also prevent the possibility of damage by overheating should a fire be started in it before the heating season.

When boilers have been drained because of a possibility of freezing, a prominent and easily read sign should be placed on them to warn that they are not to be fired until filled and properly prepared for service.

Other Maintenance Practices

An additional worthwhile maintenance procedure is to further inspect the boiler to determine that no cracks or leaks exist and that there are no air leaks in the breeching. Any cracked or warped cleanout doors that require sealing, repair or replacement, should be so marked. The boiler and breeching should be made as air tight as possible for greater operating economy.

When the boiler has been checked, then all piping, joints and fittings in the steam and water lines should be examined for leaks or corrosion. All leaks should be repaired and badly corroded parts renewed.

Return Piping

It is important that all return piping be carefully examined at frequent intervals, especially during the idle season.

The water level in the boiler should be watched during the early part of the idle season to see whether any water is being lost. If so, and if the boiler is known to be free from leaks, the return piping should be carefully examined to determine where the water is escaping. If any portion of the return piping is buried, it is probable that the leak is in that section. This buried section of piping should then be subjected to a hydrostatic pressure test or dug up and exposed for an examination. All deteriorated piping should be replaced, preferably redesigning the system so that the piping will be accessible for inspection. If the piping must be below floor level, it is preferable that it be placed in a trench with a protective cover that may be removed.

In any case where piping is buried, whether leakage is in evidence or not, it is advisable to subject that piping periodically to a hydrostatic test.

Service all Controls

During the idle period, all operating controls, such as the water glass, safety or relief valves, low water fuel cutout, emergency water feeder, pressure controls and firing controls, including any automatic firing device, should be carefully gone over and put in good order.

The water gage glass is an important device on a steam heating boiler. The gage glass connections should be checked during each idle period to determine that they are open and free so as to give a true indication of the water level.

Low water fuel cutouts and emergency water feeders should be dismantled and checked during the idle summer months.

Safety and Relief Valves

There are now available for use with hot water heating and supply boilers, relief valves of a type that have been tested and approved by the National Board of Boiler and Pressure Vessel Inspectors and stamped as complying with the current requirements of the ASME heating boiler code. Such valves are more reliable than the older type of water relief valves. Serious consideration should be given to replacing any existing non-code water relief valves with the new type valves for greater protection.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL *SECTION*

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Cooling Loads from Sunlit Glass and Wall

By C. O. Mackey* and N. R. Gay, Ithaca, N. Y.**

SUMMARY—This is a continuation of a study of the relation between cooling load and the instantaneous rate of heat gain from solar radiation.

Previous results confirmed the accuracy of a hydraulic analogue in solving complex problems of heat transfer in the study of cooling loads, and such a device has been employed in arriving at the results of this paper.

The prototype is a room assumed to be one of many in a multi-story office building, and the only source of heat gain is assumed to be from sunlit glass and sunlit wall facing south. The construction of the model analogue is described in some detail. Several different methods of operating an air conditioning system to handle the cooling loads are simulated and in each case the peak cooling load is found to be only a fraction of the peak instantaneous rate of heat gain.

THE PURPOSE of this study was to add to the information concerning the relation between cooling load and instantaneous rate of heat gain by setting up on the hydraulic analogue a more complex problem than had previously been attempted. Cooling load was found at each hour of the day for a typical office of a multi-story office building under conditions where the sources of heat gain were assumed to be from sunlit glass and sunlit wall. These observed cooling loads may then be compared with the instantaneous rates of heat gain.

Room Size and Construction

The room size assumed was 20 ft by 20 ft by 8 ft. The room was assumed to have one exterior wall with 50 percent single-thickness window glass. The assumed construction of the exterior wall was 4 in. brick veneer on the weather side, 6 in. concrete, metal lath and plaster, furred. The office was assumed to be one of many in a multi-story office building and the floor and ceiling were of identical construction, 4 in. stone concrete. The exterior walls or partitions were assumed to be of 3 in. hollow tile plastered on both sides.

The office to be studied was assumed to be adjacent on three sides to similar rooms so that the midplane of each partition is an adiabatic surface across which there is no flow of heat at any time. The ceiling of the office acts as the floor of a similar room above, and the floor of the office acts as the ceiling of a similar room below.

The properties of the materials used in the solution of this problem are shown in Table 1. It should be noted that the thermal conductances and heat storage capacities are expressed per square foot of floor.

Conditions of Heat Transfer

The exterior wall of the room was assumed to face south. There was assumed to be no infiltration of outdoor air and no internal sources of heat. Heat gain was entirely from glass and exterior wall transmission. The interior surfaces of the room were assumed to be in convection heat exchange with indoor air and in radiant energy exchange with each other. The solar and sky radiation directly transmitted by the glass were assumed to fall uniformly over the entire *floor;* this assumption departs the most from actual conditions. The water vapor in the room air was assumed to absorb no radiant energy.

Solar and sky radiation directly transmitted by the single glass in

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**Associate Professor of Mechanical Engineering, Cornell University. Member of ASHVE.

Presented at the Semi-Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Swampscott, Mass., June 1954.

Table 1—Thermal Conductances and Heat Storage Capacities per Square Foot of Floor Area

Surface	Thickness	Area of Surface per sq ft of floor	Thermal Conductance per sq ft of floor	Heat Storage Capacity per sq ft of floor
	in.	ft²	Btu/(hr) (F deg)	Btu/F deg
Floor	2[a]	1	6.0	5.317
Ceiling	2[a]	1	6.0	5.317
Partitions	1.5[a]	1.2	1.464	2.4
Exterior Wall:				
Face Brick	4[b]	0.2	0.46	1.707
Concrete	6[b]	0.2	0.40	3.19
Lath and plaster, furred		0.2	0.20	0.21
Glass		0.2	1.79	0

[a]Thickness to mid-plane
[b]Total thickness

Table 2—Radiation Directly Transmitted Through South Glass and Falling Uniformly on Floor

Hours after Noon	Radiation Transmitted per sq ft of Glass Btu/hr	Radiation Transmitted per sq ft of floor Btu/hr
0	98	19.6
1	90	18.0
2	69	13.8
3	42	8.4
4	18	3.6
5	11	2.2
6	7	1.4
7 through 17	0	0
18	7	1.4
19	11	2.2
20	18	3.6
21	42	8.4
22	69	13.8
23	90	18.0
Total for 24 hours	572	114.4

Table 3—Assumed Values of the Sol-Air Temperature for the South Wall

Hours after Noon	Sol-Air Temperature, F	Hours after Noon	Sol-Air Temperature, F
0	114	12	77
1	115	13	76
2	111	14	76
3	104	15	75
4	99	16	74
5	95	17	74
6	91	18	74
7	88	19	75
8	85	20	82
9	83	21	93
10	81	22	102
11	79	23	110

Average sol-air temperature for 24 hours, 89 F

Table 4—Assumed Values of Convection Coefficients of Heat Transfer

Surface	Convection Coefficient of Heat Transfer Btu/(hr) (sq ft) (F deg)
Weather-side wall	4.0
Weather-side glass	4.0
Room-side wall	0.45
Room-side glass	0.45
Floor	0.60
Ceiling	0.30
Partitions	0.40

Table 5—Angle Factors for Radiation Exchanges

Surfaces	Angle Factor	
	Symbol	Value
Floor to ceiling (Ceiling to floor)	F_{fc}	0.48
Floor to glass (Ceiling to glass)	F_{fg}	0.065
Floor to net wall (Ceiling to net wall)	F_{fw}	0.065
Floor to Partitions (Ceiling to partitions)	F_{fp}	0.39
Partitions to glass	F_{pg}	0.058
Partitions to net wall	F_{pw}	0.058

Table 6—The Resistance Tubes of the Analogue (All resistances are for one square foot of floor area).

Resistance Tube Symbol	Represents	Numerical Value of Thermal Resistance (hr) (F deg)/Btu
R_1	Conduction resistance of 1 in. of floor or ceiling	0.0833
R_2	Conduction resistance of one-half of partitions	0.683
R_3	Convection resistance of outdoor air near wall	1.25
R_4	Conduction resistance of 2 in. of face brick	1.09
R_5	Conduction resistance of 2 in. of concrete wall	0.833
R_6	Conduction resistance of one-half of furred lath and plaster	2.5
R_7	Combined resistances, outdoor air convection and glass conduction	1.81
R_8	Convection resistance of floor to room air	1.67
R_9	Convection resistance of glass to room air	11.1
R_{10}	Convection resistance of wall to room air	11.1
R_{11}	Convection resistance of ceiling to room air	3.33
R_{12}	Convection resistance of partitions to room air	2.08
R_{13}	Radiation resistance floor to ceiling	2.08
R_{14}	Radiation resistance ceiling to partitions	2.56
R_{15}	Radiation resistance partitions to wall	14.4
R_{16}	Radiation resistance ceiling to wall	15.4
R_{17}	Radiation resistance floor to wall	15.4
R_{18}	Radiation resistance floor to glass	15.4
R_{19}	Radiation resistance ceiling to glass	15.4
R_{20}	Radiation resistance partitions to glass	14.4
R_{21}	Radiation resistance floor to partitions	2.56

the south wall was assumed to be representative of a location at 40 deg N latitude on August 1 with the values shown in Table 2.

For simplicity in establishing the convection and radiation heat transfer from the room-side surface of the glass, the temperature of the outdoor air in contact with the glass was assumed to be 83 F, the average daily design air temperature for clear atmospheres.

To establish the convection and radiation heat transfer from the room-side surface of the exterior wall, the sol-air temperature assumed for this wall was the design value for a surface with a solar absorptivity of 0.9 facing south; these values are given in Table 3.

It is necessary to decide upon various surface convection coefficients of heat transfer before the analogue is designed. The values assumed in this study are shown in Table 4.

For the exchange of energy by radiation between the room-side surfaces, it was assumed that the rate of such exchange was 1.0 Btu per (hr) (sq ft) (F deg). In other words, an equivalent convection coefficient of 1.0 was used. The angle factors, or the fraction of the radiant energy emitted by one surface that is incident upon another surface, were found and are given in Table 5.

The Analogue

The hydraulic analogue is shown in schematic form in Fig. 1 and as it actually appears in Fig. 2. Since the general principle of this analogue has been explained in a previous paper* this discussion is limited to an explanation of the specific design for the particular study. Copper tubing of proper diameter and length was used for the equivalents of the thermal resistances R, while glass tubes of proper areas of cross section were used for the equivalents of the heat storage capacities C. To indicate the surface temperatures, glass tubes T of the

*Cooling Load From Sunlit Glass, by C. O. Mackey and N. R. Gay (ASHVE TRANSACTIONS, Vol. 58, 1952, p. 321).

Letters and subscripts are defined in Tables 6, 7, and 8.

Table 7—The Capacity Tubes of the Analogue (All capacities are for one square foot of floor area).

Capacity Tube Symbol	Represents	Numerical Value of Capacity, Btu/F deg
C_1	Capacity of 1 in. of floor or ceiling	2.658
C_2	Capacity of one-half of partitions	2.4
C_3	Capacity of 2 in. of face brick	0.953
C_4	Capacity of 2 in. of concrete wall	1.063
C_5	Capacity of metal lath and plaster	0.21

smallest diameter that would not introduce capillary effects were used. The resistance tubes are explained in Table 6, and the capacity tubes are explained in Table 7. The temperature tubes are explained in Table 8.

In the design of the analogue, the following scale factors were used:

Time: a time of one minute in the analogue represented a time of one hour in the prototype.

Temperature: a rise in level of the liquid in the tubes of one inch represented a temperature rise of 1 F deg in the prototype.

Rate of heat flow: a flow of liquid at the rate of 6 cc per min in the analogue represented heat flow at the rate of 1 Btu per (hr) (sq ft of floor) in the prototype.

A pump was designed to give a variable delivery with time; the complete cycle of the pump had a period of 24 min. With one design of cam, this pump reproduced the effect of a supply of heat directly to the floor at the rate shown in Table 2 for solar radiation transmitted directly through south glass. This liquid was supplied through a ¾ in. O.D. copper tube to temperature tube T_1.

Liquid was also supplied under manual control to temperature tube T_7; this liquid level was adjusted to represent the temperature of outdoor air near the glass. In these studies, this level was maintained constant to correspond to a steady temperature of 83 F.

Liquid was supplied under manual control to temperature tube T_6; this liquid level was adjusted to represent the sol-air temperature for the exterior wall. For a south wall, the temperature schedule reproduced every 24 min was that shown in Table 3.

Liquid was drawn off through a needle valve in the line connected to temperature tube T_9. Any cycle of indoor air temperature may be maintained manually; for a constant temperature of the room air, for example, the level of the liquid in T_9 is held constant at the desired value.

Fig. 1—Schematic diagram of the analogue

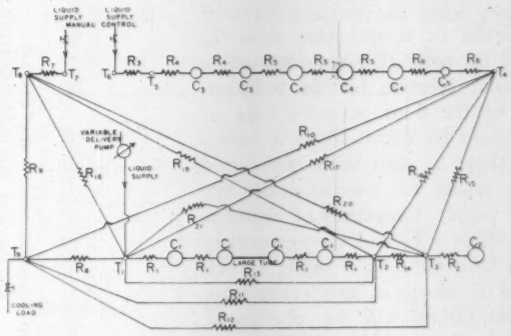


Table 8—The Temperature Tubes of the Analogue

Temperature Tube Symbol	Temperature
T_1	Floor Surface
T_2	Ceiling Surface
T_3	Partition Surface
T_4	Room-side surface of wall
T_5	Weather-side surface of wall
T_6	Wall sol-air
T_7	Outdoor air near glass
T_8	Room-side surface of glass
T_9	Room air

This liquid was collected in glass graduates, and the rate of its collection was measured. The cooling load may then be found either from the measured rate of collection of the liquid or by calculation from the observed instantaneous temperatures of the room surfaces, t_f, t_c, t_p, t_w, and t_g.

These studies are studies of periodic heat transfer in the unsteady state. The period of the cycle was always 24 hr in the prototype (24 min in the analogue). In other words, the design conditions were assumed to recur each day for several days. In such a study, the starting conditions are not known;

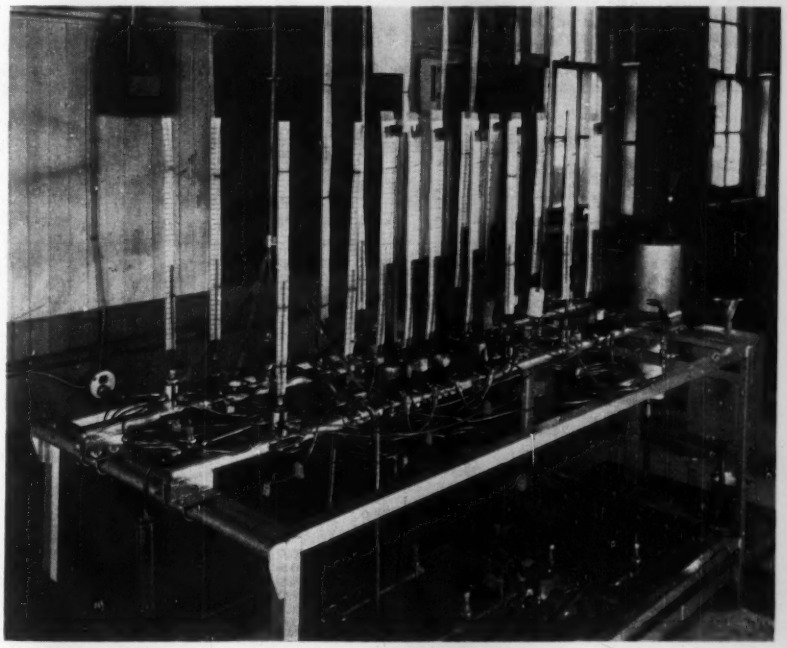


Fig. 2—The hydraulic analogue

in other words, it is not known, for example, what the starting level of the liquid in temperature tube T_1 should be, since if it were known, a particular solution for the temperatures of the floor at some time of day would be known. It is necessary, then, to start with any liquid levels, repeat for several cycles the pump supply, the supply of liquid to tubes T_6 and T_7 and the removal of liquid from tube T_9. After several cycles, the effects of any wrong starting conditions will be eliminated. Then, further repetition will not appreciably change the levels of the liquid in any tube at a particular time in the cycle. When this *steady* periodic state has been reached, a solution to the problem set up on the analogue has been found.

Solutions

Case A: The temperature of the indoor air was assumed to be held constant for the 24-hr period at 75 F. The exposed wall and glass were assumed to face south. The sol-air temperature for the south wall, exclusive of glass, was that shown in Table 3, while the temperature of the outdoor air near the glass was assumed constant at 83 F. The pump delivery did not reproduce, exactly, the direct transmission of solar and sky radiation shown in Table 2, but it was close enough to these values for the purpose of this study. The results obtained with the analogue are shown in Table 9. The observed temperatures of the five different room surfaces appear in this table. The cooling load at each hour was calculated by finding the rate of heat transfer by convection from these surfaces to room air; a sample calculation is shown in Example 1.

The instantaneous rates of heat gain were also calculated from the observed temperatures. These gains consist of the solar and sky radiation directly transmitted by the glass, the transfer of heat by convection to room air from the inside surface of the glass and exposed wall, and the transfer of heat by radiation to surrounding surfaces from glass and exterior wall. A sample calculation is shown in Example 2.

The cooling loads and instantaneous rates of heat gain per square foot of floor are plotted against the time of day in Fig. 3.

The total cooling load in 24 hr should check the total instantaneous rate of heat gain for the same period. Actually, these totals differ by about 8 percent, which is a reasonable accuracy for such an analogue study.

It will be observed that the maximum cooling load is about 9.0 Btu per hr for each sq ft of floor at about 2:00 p.m.; the maximum instantaneous rate of heat gain is about 17.4 Btu per hr at 12:00 noon. *In this case, then, the peak cooling load is 52 percent of the peak instantaneous rate of heat gain and occurs with a time lag of 2 hr.* The ratio of the peak cooling load to the 24 hr average instantaneous rate of heat gain is 1.44.

Case B: The structure and its orientation were assumed to be the same as in *Case A*. There was assumed to be a supply of conditioned air for 12 hr of the day between 7 a.m. and 7 p.m. to maintain a constant temperature of the indoor air of 75 F; during the remainder of the day, there was no drawing off of

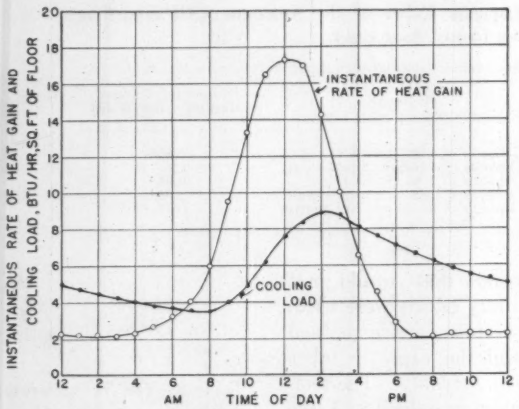


Fig. 3—Case A: Constant room air temperature

Table 9—Results for Case A (constant temperature of the room air of 75F)

Sun Time	Room Surface Temperatures, F					Cooling Load per sq ft floor Btu/hr	Instantaneous Rate of Heat Gain per sq ft of floor, Btu/hr			
							Direct Glass	Radiation & Convection		Total
	Floor	Ceiling	Partitions	Wall	Glass			Glass	Wall	
12 noon	81.7	79.4	77.7	79.3	81.4	7.60	16.10	0.94	0.33	17.37
1 p.m.	82.2	80.3	78.0	79.7	81.6	8.37	15.78	0.89	0.34	17.01
2	82.5	80.9	78.3	80.3	81.7	8.93	13.00	0.84	0.43	14.27
3	81.9	81.2	78.4	80.7	81.6	8.74	8.66	0.82	0.56	10.04
4	81.0	80.9	78.4	81.0	81.5	8.13	4.95	0.87	0.73	6.55
5	80.4	80.4	78.3	81.3	81.4	7.59	2.74	0.92	0.89	4.55
6	79.9	80.0	78.2	81.4	81.4	7.13	0.93	0.99	0.99	2.91
7	79.5	79.6	78.1	81.4	81.3	6.71	0.05	1.02	1.05	2.12
8	79.1	79.2	77.9	81.4	81.2	6.25	0	1.05	1.11	2.16
9	78.8	78.9	77.8	81.3	81.2	5.91	0	1.15	1.13	2.28
10	78.5	78.6	77.6	81.1	81.2	5.55	0	1.15	1.13	2.28
11	78.3	78.4	77.5	80.9	81.1	5.28	0	1.16	1.10	2.26
12 midnight	78.1	78.2	77.4	80.7	81.0	5.03	0	1.16	1.08	2.24
1 a.m.	77.9	78.0	77.3	80.5	81.0	4.78	0	1.19	1.05	2.24
2	77.7	77.8	77.2	80.2	81.0	4.52	0	1.23	1.00	2.23
3	77.6	77.6	77.1	79.9	81.0	4.33	0	1.25	0.93	2.18
4	77.4	77.4	76.9	79.6	80.9	4.02	0.18	1.27	0.89	2.34
5	77.3	77.3	76.8	79.3	80.9	3.85	0.56	1.29	0.82	2.67
6	77.2	77.2	76.8	79.1	80.9	3.74	1.19	1.30	0.78	3.27
7	77.1	77.1	76.7	78.8	80.9	3.58	2.04	1.32	0.71	4.07
8	77.1	77.0	76.6	78.6	80.9	3.48	3.98	1.33	0.67	5.98
9	77.9	77.2	76.7	78.5	81.0	4.07	7.72	1.29	0.56	9.57
10	78.9	77.6	76.9	78.5	81.1	4.90	11.63	1.21	0.46	13.30
11	80.4	78.4	77.2	78.8	81.2	6.22	15.00	1.07	0.38	16.45
			Total for 24 hr			138.71	104.51	26.71	19.12	150.34

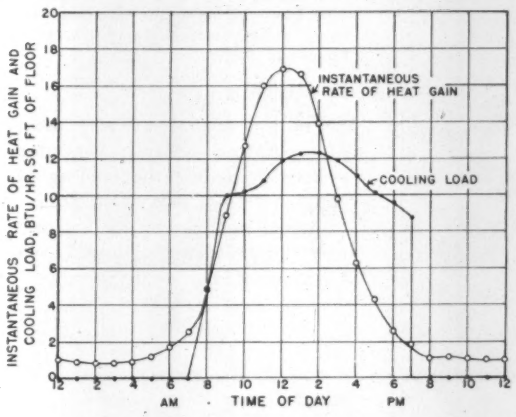

INSTANTANEOUS RATE OF HEAT GAIN AND COOLING LOAD, BTU/HR, SQ FT OF FLOOR
INSTANTANEOUS RATE OF HEAT GAIN
COOLING LOAD
AM
TIME OF DAY
PM

Fig. 4—Case B: Air conditioning on only between 7 a.m. and 7 p.m.

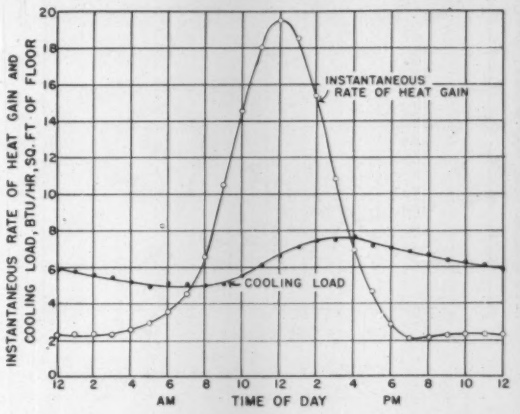

INSTANTANEOUS RATE OF HEAT GAIN AND COOLING LOAD, BTU/HR, SQ. FT OF FLOOR
INSTANTANEOUS RATE OF HEAT GAIN
COOLING LOAD
AM
TIME OF DAY
PM

Fig. 5—Case C: Steady supply of conditioned air at a fixed dry-bulb temperature

Example 1—Calculation of Cooling Load

Time—12 noon: Cooling load per sq ft of floor is

$$0.6(81.7-75)+0.3(79.4-75)+0.4(480/400)\ (77.7-75)$$
$$+0.45(80/400)\ (79.3-75)+0.45(80/400)\ (81.4-75)=7.60 \text{ Btu/hr}$$

Example 2—Calculation of Instantaneous Rates of Heat Gain

Time—12:00 noon: Direct transmission by glass is 16.1 Btu per hr for each sq ft of floor; this figure comes from the calibrated pump discharge and is not exactly the same as the values given in Table 2.

Convection from glass	$=0.45(80/400)\ (81.4-75)=$	0.576
Radiation from glass to floor	$=0.065(81.4-81.7)=$	−0.020
Radiation from glass to ceiling	$=0.065(81.4-79.4)=$	0.130
Radiation from glass to partitions	$=0.058(1.2)(81.4-77.7)=$	0.257
Convection and radiation from glass per sq ft floor	$=0.576+0.367=$	0.94 Btu/hr
Convection from wall	$=0.45(80/400)(79.3-75)=$	0.387
Radiation from wall to floor	$=0.065(79.3-81.7)=$	−0.156
Radiation from wall to ceiling	$=0.065(79.3-79.4)=$	−0.007
Radiation from wall to partitions	$=0.058(1.2)(79.3-77.7)=$	0.111
Convection and radiation from wall per sq ft floor	$=0.387-0.052=$	0.33 Btu/hr
Total instantaneous rate of heat gain per sq ft floor	$=16.10+0.94+0.33=$	17.37 Btu/hr

liquid from the analogue[6] to simulate a shutting down of the air conditioning equipment. The results obtained with the analogue are shown in Table 10 and in Fig. 4.

Case C: The structure and its orientation were assumed to be the same as in *Case A*. A constant setting was used on the needle valve to draw off liquid from the system. In effect, this is similar to a constant rate of supply of conditioned air at a constant dry-bulb temperature to the office during the entire 24-hr period; the cooling load remains nearly constant. The results obtained with the analogue are shown in Table 11 and in Fig. 5.

Case D: The structure and its orientation were assumed to be the same as in *Case A*. The only difference was that the indoor air temperature was assumed to

Table 10—Results for Case B (Air conditioning on between 7 a.m. and 7 p.m. and off for the rest of the day)

Sun Time	Room Surface Temperatures, F					Room Air Temp., F	Cooling Load per sq ft floor Btu/hr	Instantaneous Rate of Heat Gain per sq ft of floor, Btu/hr			
	Floor	Ceiling	Partitions	Wall	Glass			Direct Glass	Radiation & Convection		Total
									Glass	Wall	
12 noon	84.9	82.5	80.2	81.0	82.1	75.0	11.87	16.10	0.56	0.25	16.91
1 p.m.	85.1	83.2	80.3	81.5	82.2	75.0	12.30	15.78	0.53	0.33	16.64
2	85.0	83.5	80.3	81.8	82.2	75.0	12.35	13.00	0.51	0.40	13.91
3	84.2	83.5	80.3	82.1	82.2	75.0	11.90	8.66	0.57	0.54	9.77
4	83.1	83.1	80.1	82.3	82.0	75.0	11.02	4.95	0.62	0.71	6.28
5	82.2	82.4	79.8	82.4	81.8	75.0	10.12	2.74	0.69	0.86	4.29
6	81.8	81.8	79.6	82.4	81.7	75.0	9.60	0.93	0.74	0.94	2.61
7	81.0	81.2	79.3	82.4	81.6	75.0	8.79	0.05	0.82	1.05	1.92
8	81.8	81.3	80.6	83.8	82.4	81.3	0	0	0.34	0.74	1.08
9	81.4	81.3	80.8	84.0	82.4	81.4	0	0	0.34	0.80	1.14
10	81.4	81.4	81.0	84.0	82.4	81.5	0	0	0.31	0.77	1.08
11	81.5	81.4	81.2	84.0	82.4	81.6	0	0	0.28	0.74	1.02
12 midnight	81.5	81.5	81.3	83.9	82.5	81.7	0	0	0.29	0.69	0.98
1 a.m.	81.6	81.5	81 4	83.8	82.5	81.7	0	0	0.27	0.65	0.92
2	81.6	81.6	81.5	83.6	82.5	81.8	0	0	0.25	0.57	0.82
3	81.7	81.6	81.6	83.5	82.6	81.8	0	0	0.27	0.53	0.80
4	81.7	81.7	81.7	83.3	82.6	81.8	0	0.18	0.25	0.45	0.88
5	81.8	81.7	81.8	88.1	82.6	81.9	0	0.56	0.23	0.38	1.17
6	81.8	81.8	81.8	82.9	82.6	81.9	0	1.19	0.22	0.31	1 72
7	81.8	81.8	81.8	82.7	82.6	82.0	0	2.04	0.21	0.24	2.49
8	81.7	81.6	81.2	81.9	82.3	78.5	4.80	3.98	0.50	0.39	4.87
9	82.3	81.4	80.3	81.0	81.8	75.0	9.99	7.72	0.71	0.48	8.91
10	82.8	81.5	80.0	80.7	81.8	75.0	10.16	11.63	0.69	0.37	12.69
11	83.8	81.9	80.0	80.8	82.0	75.0	10.80	15.00	0.66	0.31	15.97
				Total for 24 hr			123.70	104.51	10.86	13.50	128.87

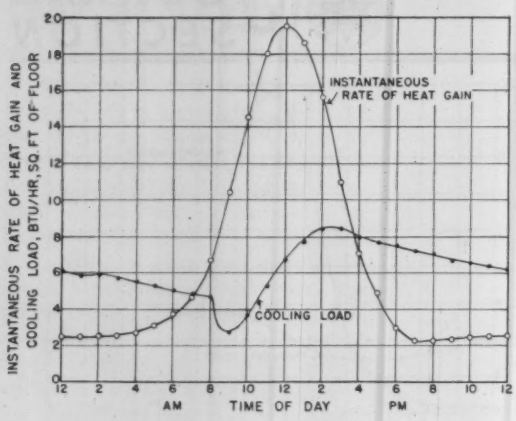

INSTANTANEOUS RATE OF HEAT GAIN AND COOLING LOAD, BTU/HR, SQ FT OF FLOOR
INSTANTANEOUS RATE OF HEAT GAIN
COOLING LOAD
TIME OF DAY
AM
PM

Fig. 6—Case D: Night pre-cooling

be constant at 75 F between 8 a.m. and 5 p.m., while this temperature was allowed to drop to as low as 73 F during the evening hours. The results obtained with the analogue in this test are shown in Table 12 and in Fig. 6.

Conclusion

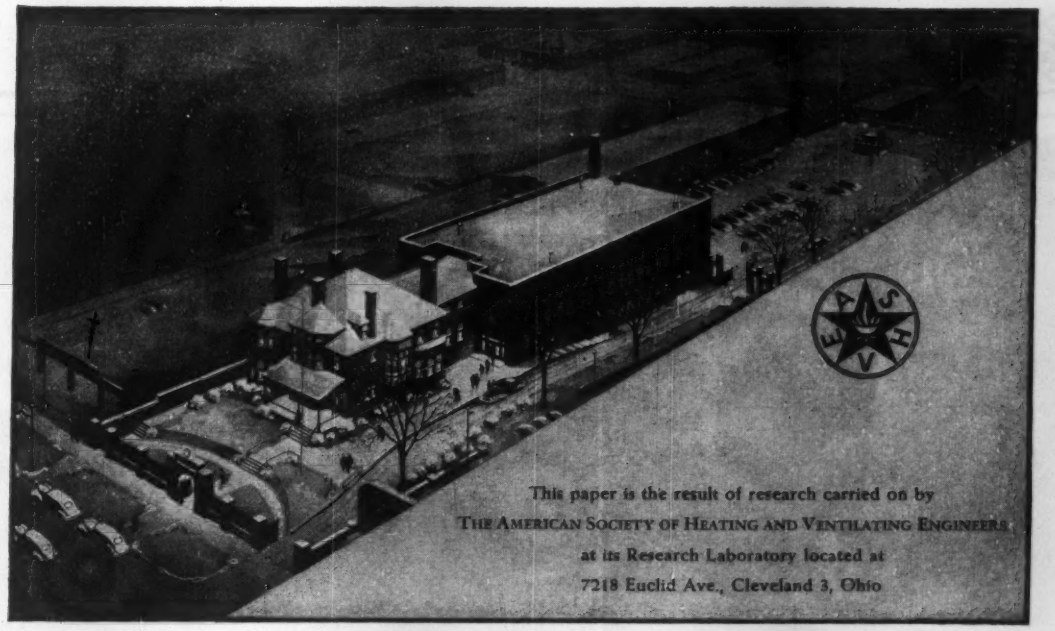
For the several different methods of operating an air conditioning system to handle the cooling loads simulated for *Cases A* to *D*, it will be noted in Figs. 3 to 6 that in each case the peak cooling load is only a fraction of the peak instantaneous rate of heat gain.

Table 11—Results of Case C (Steady supply of conditioned air at a fixed dry-bulb temperature)

Sun Time	Room Surface Temperatures, F					Room Air Temp., F	Cooling Load per sq ft floor Btu/hr	Instantaneous Rate of Heat Gain per sq ft of floor, Btu/hr			
	Floor	Ceiling	Partitions	Wall	Glass			Direct Glass	Radiation & Convection: Glass	Radiation & Convection: Wall	Total
12 noon	81.3	78.9	77.2	78.9	81.4	75.2	6.62	18.20	1.02	0.30	19.52
1 p.m.	81.9	79.7	77.8	79.6	81.6	75.5	7.18	17.27	0.90	0.33	18.50
2	82.3	80.7	78.3	80.3	81.7	75.8	7.51	14.22	0.79	0.39	15.40
3	81.9	81.1	78.6	80.9	81.8	75.8	7.59	9.48	0.80	0.54	10.82
4	81.7	81.0	78.7	81.3	81.7	75.7	7.67	5.42	0.80	0.68	6.90
5	80.6	80.7	78.6	81.5	81.6	75.5	7.20	3.00	0.88	0.85	4.73
6	80.2	80.2	78.5	81.6	81.5	75.3	7.07	1.02	0.94	0.97	2.93
7	79.7	79.8	78.3	81.6	81.4	75.1	6.85	0.06	1.00	1.06	2.12
8	79.3	79.4	78.2	81.5	81.3	74.9	6.74	0	1.05	1.11	2.16
9	78.9	79.0	77.9	81.3	81.3	74.8	6.38	0	1.13	1.13	2.26
10	78.6	78.7	77.7	81.1	81.2	74.6	6.30	0	1.17	1.14	2.31
11	78.2	78.3	77.5	80.8	81.1	74.4	6.12	0	1.22	1.14	2.36
12 midnight	77.9	78.0	77.3	80.5	80.9	74.3	5.86	0	1.23	1.11	2.34
1 a.m.	77.7	77.8	77.0	80.2	80.9	74.2	5.85	0	1.29	1.08	2.37
2	77.4	77.5	76.8	79.8	80.9	74.0	5.57	0	1.35	1.04	2.39
3	77.2	77.3	76.7	79.5	80.8	73.9	5.47	0	1.37	0.99	2.36
4	76.9	77.0	76.4	79.2	80.8	73.8	5.19	0.20	1.44	0.97	2.61
5	76.7	76.8	76.3	78.8	80.7	73.8	4.91	0.61	1.44	0.89	2.94
6	76.7	76.7	76.2	78.5	80.6	73.6	5.11	1.30	1.44	0.84	3.58
7	76.6	76.6	76.0	78.2	80.6	73.5	5.05	2.24	1.48	0.78	4.50
8	76.6	76.4	75.8	77.8	80.6	73.4	5.01	4.36	1.52	0.70	6.58
9	77.4	76.5	75.9	77.7	80.7	73.7	5.10	8.46	1.45	0.58	10.49
10	78.4	77.1	76.2	77.9	80.8	74.0	5.58	12.74	1.33	0.49	14.56
11	79.8	77.8	76.7	78.3	81.0	74.5	6.15	16.42	1.17	0.39	17.98
				Total for 24 hr			148.08	115.00	28.21	19.50	162.71

Table 12—Results for Case D (Night Pre-cooling)

Sun Time	Room Surface Temperatures, F					Room Air Temp., F	Cooling Load per sq ft floor Btu/hr	Instantaneous Rate of Heat Gain per sq ft of floor, Btu/hr			
	Floor	Ceiling	Partitions	Wall	Glass			Direct Glass	Radiation & Convection: Glass	Radiation & Convection: Wall	Total
12 noon	81.1	78.8	77.1	78.8	81.4	75.0	6.73	18.20	1.07	0.30	19.57
1 p.m.	81.7	79.8	77.6	79.5	81.5	75.0	7.70	17.27	0.96	0.37	18.60
2	82.1	80.5	78.0	80.2	81.7	75.0	8.42	14.22	0.91	0.48	15.61
3	81.7	80.9	78.3	80.7	81.7	75.0	8.49	9.48	0.89	0.60	10.97
4	80.9	80.8	78.3	81.0	81.6	75.0	7.99	5.42	0.92	0.75	7.09
5	80.4	80.4	78.2	81.3	81.5	74.9	7.70	3.00	0.97	0.91	4.88
6	79.8	80.0	78.1	81.3	81.3	74.7	7.47	1.02	1.00	0.93	2.95
7	79.3	79.5	77.9	81.3	81.3	74.5	7.23	0.06	1.10	1.10	2.26
8	78.9	79.0	77.7	81.2	81.2	74.3	7.04	0	1.16	1.16	2.32
9	78.5	78.6	77.5	81.0	81.0	74.2	6.70	0	1.18	1.17	2.35
10	78.1	78.3	77.3	80.8	80.9	74.0	6.56	0	1.22	1.19	2.41
11	77.8	77.9	77.0	80.5	80.0	73.8	6.40	0	1.28	1.19	2.47
12 midnight	77.5	77.6	76.8	80.2	80.8	73.7	6.16	0	1.34	1.17	2.51
1 a.m.	77.2	77.3	76.5	79.8	80.8	73.6	5.87	0	1.41	1.12	2.53
2	76.9	77.1	76.3	79.4	80.7	73.3	5.96	0	1.45	1.08	2.53
3	76.7	76.8	76.1	79.0	80.6	73.2	5.76	0	1.48	1.04	2.52
4	76.4	76.5	75.9	78.7	80.6	73.1	5.52	0.20	1.54	0.99	2.73
5	76.2	76.3	75.7	78.3	80.5	73.0	5.36	0.61	1.56	0.92	3.09
6	76.0	76.1	75.5	77.9	80.5	73.0	5.05	1.30	1.60	0.85	3.75
7	75.9	75.9	75.4	77.6	80.4	73.0	4.84	2.24	1.60	0.79	4.63
8	76.0	75.7	75.3	77.4	80.4	73.0	4.77	4.36	1.61	0.74	6.71
9	77.1	76.1	75.8	77.7	80.8	75.0	2.74	8.46	1.41	0.52	10.39
10	78.1	76.8	76.1	77.9	80.9	75.0	3.72	12.74	1.31	0.44	14.49
11	79.8	77.7	76.6	78.3	81.2	75.0	5.32	16.42	1.20	0.36	17.98
				Total for 24 hr			149.50	115.00	30.17	20.17	165.34


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Irradiation of Vertical and Horizontal Surfaces by Diffuse Solar Radiation from Cloudless Skies

By G. V. Parmelee*, Cleveland, Ohio

SUMMARY — The intensity of diffuse solar radiation on horizontal and vertical surfaces has been measured at Cleveland, Ohio, on cloudless days and shown to be inversely proportioned to the clearness of the atmosphere. With these data, curves have been prepared which provide a means of estimating the diffuse and direct components of solar radiation incident upon a vertical surface of any orientation or upon a horizontal surface. Information required for these estimates consists of the altitude of the sun and measurements of the total solar radiation incident upon a horizontal surface, such as are made at U. S. Weather Bureau stations. Procedures are provided by which allowances can be made for different ground reflectances and horizon obstructions. Further study of the relationships which have been developed is suggested.

RECENT YEARS have seen a growing interest in solar radiation and its influence on engineering problems for several reasons. For example, the design of systems which utilize solar energy for heating in cold weather or for operating absorption refrigeration systems in hot weather requires detailed knowledge of solar energy intensities. Correlation of weather data to establish suitable bases for estimating cooling and heating loads must take solar radiation into account. Also the solution of the problem of improving the livability of buildings in hot climates without the benefit of air conditioning depends in part upon adequate solar intensity data. Many data are available, most of them as measurements of total solar radiation on a horizontal surface. These measurements are now regularly made at about 70 stations in the United States, its outlying possessions and in Canada. However, the data needed by the engineer are the components of the total incident solar radiation: (1) the direct or beamed radiation as a function of the altitude of the sun; and (2) the amount of diffuse radiation which falls on a surface of given orientation at a given time. The diffuse component arises from the scattering of the direct beam by various constituents of the atmosphere and on a vertical surface includes ground reflected solar radiation.

Considerable information on these two components of solar energy has been collected during the course of research[1,2] carried on at the ASHVE Research Laboratory in Cleveland to determine solar heat gain from various types of fenestrations. This

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[1]Exponent numerals refer to References.

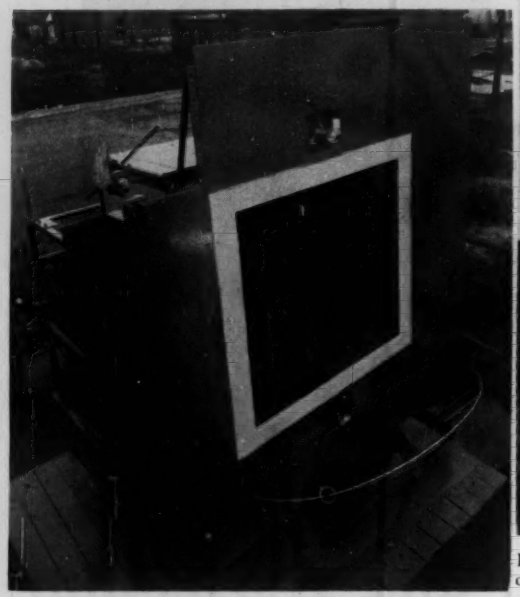

Fig. 1—Close-up view showing pyrheliometers mounted on calorimeter for measuring solar radiation on a vertical surface. A shading disc and the method of adjusting it is also shown. The calorimeter faces west

Fig. 2—Solar radiation on a horizontal surface was measured by a pyrheliometer mounted on the tower. The tower is on the northwest corner

research was carried on under the direction of the TAC on Heat Flow Through Glass†. Preliminary analysis of the data showed that the intensity of the direct beam varied widely for a given solar altitude and cloudless skies, and that as the intensity of the direct beam decreased, the intensity of the scattered or diffuse solar radiation tended to increase. This relationship has been developed and is the subject of this paper. It provides means for computing the direct and diffuse components of the total radiation which falls on a horizontal plane.

A second step permits an estimate to be made of the diffuse and direct components of the radiation which falls on a vertical surface of any orientation. This approach differs from those made by others, who, (1) give mean hourly, daily or seasonal values of total radiation falling on various surfaces, mean ratios of direct or total to diffuse radiation, or mean values of diffuse radiation for cloudless skies,[3-8] or (2) give methods of computing these values in terms of atmospheric conditions[9]. It will be apparent that additional investigation is needed to test and refine the generality of the relationships presented here and it is hoped that the present approach will prompt such study.

Source of Data

Period and Methods of Observation: Observations of the direct and diffuse components of solar radiation on a horizontal plane have been made throughout the course of all of the research on heat flow through glass reported in the references mentioned. In addition, many tests were made in which the special calorimeter (see Fig. 1) used in the research was set so that the test section was vertical with a fixed orientation. In all of these tests, measurements were also made of the direct and diffuse components of the solar radiation incident upon this vertical surface. In addition to data so gathered, several series of special observations were made in which the calorimeter apparatus was rotated through a full circle during which operation observations were made of the diffuse solar radiation incident upon its vertical surface at intervals of 20 to 30 deg of rotation. Measurements on a horizontal surface were made simultaneously. Most of the observations were made during the months of April through September between 1947 and 1952, but data given in this paper include measurements made in all the remaining months of the year except January.

Sky Conditions: This report includes data obtained on 30 days during this period which were wholly cloud-free, both as observed at the Laboratory and as reported at the Cleveland Weather Bureau, about 10 miles to the southwest. In addition, values are included for portions of days in which the sky was observed to be free of clouds. Despite this cloud-free condition, the clearness of the sky varied greatly from very clear days, usually those with relatively low dewpoints and low dry bulb temperatures, to very hazy days produced by the combination of large amounts of atmospheric water vapor with industrial contamination. Because sky conditions change quite rapidly, they were observed and recorded at 15 min intervals.

Ground Reflected Solar Radiation: The irradiation of vertical surfaces depends not only upon the direct and

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diffuse solar radiation received from the sky, but also upon solar radiation reflected from the ground. In general, the ground reflectance was low, as the surroundings consisted of dark areas of which the backgrounds of Fig. 1 (camera looking southeast) and of Fig. 2 (camera looking northeast) are typical. The immediate foreground was the roof of the test house. This had a measured light reflectance of about 5 percent. The average reflectance of all the surroundings is estimated to be about 10 percent. In addition, the horizon was cut off in some directions by nearby buildings with a maximum altitude of about 12 deg for the horizontal surface (the top of the tower shown in Fig. 2) and up to 15 deg with respect to the centerline of the vertical surface of the panel.

Instrumentation: All observations were made with pyrheliometers which have a *hemispherical vision*. Two were mounted on the calorimeter as shown in Fig. 1 and a third was mounted horizontally on the tower at the northwest corner of the test house roof (shown covered in Fig. 2). Measurements of diffuse radiation were made by shading the thermopile element from the direct rays of the sun by means of shading discs of such diameter and distance from the element as to exclude a 5 deg 43 min cone in the direction of the sun. One is shown in Fig. 1. Readings of electromotive force (emf) were recorded mainly on a 0-5 millivolt range electronic recording potentiometer. Total radiation on the horizontal surface was recorded at least once every 5 min and diffuse radiation recorded once every 30 to 45 min. Most vertical surface data are averages of from four to eight pyrheliometer readings over a period of 7-½ to 15 min.

The constants of the various pyrheliometers for diffuse solar radiation require some comment. In all, four different pyrheliometers were used. Comparisons under identical conditions showed that one instrument, No. 1979, developed about 15 percent more emf when exposed only to diffuse radiation on the clearest of days than the other three instruments, although all four gave the same values on overcast days and also the same values for direct beamed radiation. To make the data consistent, a sliding scale of reductions was applied to the readings of instrument No. 1979. A reduction of 15 percent was applied when the sky was clearest and no reduction was applied when the sky was very hazy.

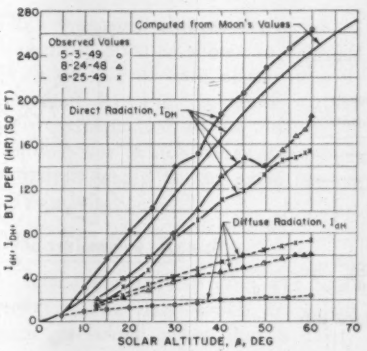


Fig. 3—Typical values of solar radiation on a horizontal plane for cloudless skies of different degrees of clearness

Typical Observations

Figs. 3, 4, 5 and 6 give typical observations of direct and diffuse solar radiation for cloudless skies with one or more of the variables held essentially constant in each case represented. Fig. 3 gives values of radiation received on a horizontal plane for three different degrees of atmospheric clearness. Fig. 4 gives values of radiation received by a vertical surface with fixed orientation (west) for two different degrees of atmospheric clearness. To compare these data with those for an atmosphere of specified atmospheric conditions, direct radiation values from Moon's[10] work are shown. His values have been used as a basis of comparison throughout this paper and the ratio of the observed intensity of direct radiation to Moon's

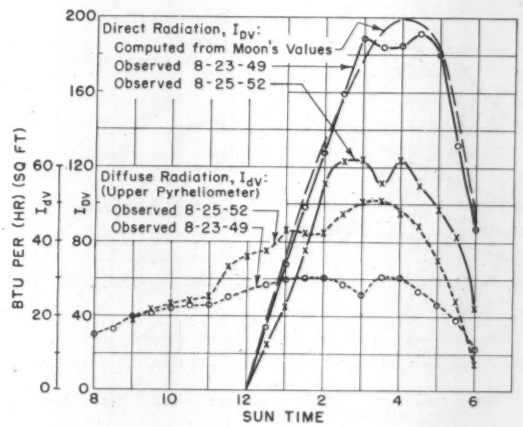


Fig. 4—Typical values of solar radiation on a west facing vertical surface for cloudless skies of different degrees of clearness

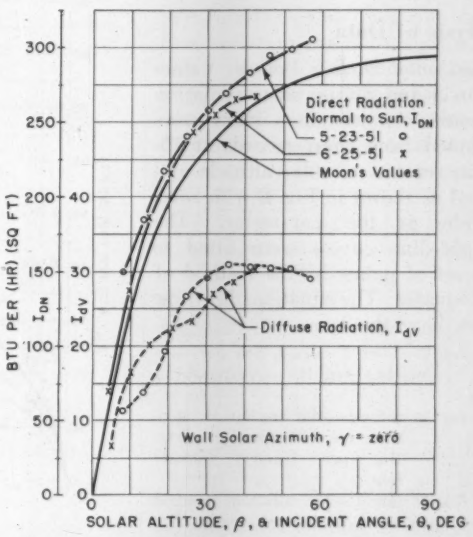


Fig. 5—Variation of vertical surface diffuse radiation with solar altitude

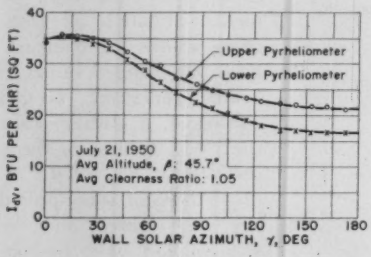


Fig. 6—Variation of vertical surface diffuse radiation with orientation

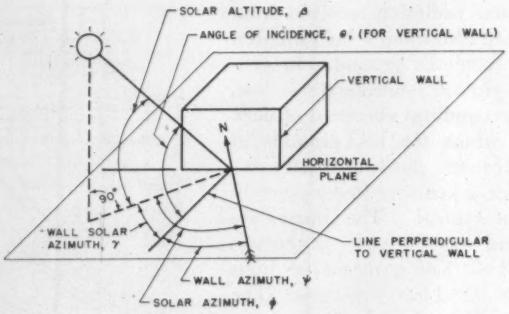


Fig. 7—Definition of solar angles

value for the same solar altitude has been designated the clearness ratio. Figs. 3 and 4 show that for the same solar altitude, the intensity of the diffuse radiation incident upon a given surface decreases as the intensity of the direct beam increases. The various angles referring to sun and wall positions in this paper are described by Fig. 7.

The influence of solar altitude, β, on vertical surface diffuse radiation with constant wall solar azimuth, γ, and very nearly constant clearness ratio is shown by Fig. 5. The influence of orientation on vertical surface radiation values for nearly constant altitude and clearness ratio is illustrated by Fig. 6. This also shows the difference in the values registered by the upper and lower pyrheliometers.

Analysis of Data

Horizontal Surface Values: Values of direct and diffuse solar radiation intensities for cloudless skies were computed from chart records at 10-deg increments of solar altitude and plotted as shown in Fig. 8 with solar altitude as the parameter. The straight line curves were fitted to each set of points by the method of least squares. The equations for these curves have the form

$$I_{dH} = X - Y\,(I_{DH}),\ \text{Btu per (hr) (sq ft)} \quad \ldots\ldots\ldots (1)$$

where

I_{dH} = diffuse solar radiation incident on a horizontal plane, Btu per (hour) (square foot).

I_{DH} = direct solar radiation incident on a horizontal plane, Btu per (hour) (square foot).

The constants X and Y are given in Table 1 and have been extrapolated as shown in Fig. 9 to obtain values for solar altitudes of 10, 70, 80, and 90 deg. Extrapolated curves for these altitudes are shown in Fig. 8 as dotted lines. The few data available for an altitude of 10 deg are shown for comparison. To show the relationship of these data to the clearness of the atmosphere, lines of constant clearness ratio have been drawn. Intersections of these curves with the straight line curves give the direct radiation on a horizontal plane and the corresponding diffuse radiation value for a given altitude of the sun. Light lines are for intermediate altitudes.

Two useful relationships derived from the straight line curves of Fig. 8 are shown in Figs. 10 and 11. Fig. 10 is a family of curves which shows the ratio of the total to diffuse solar radiation on a horizontal plane as a function of solar altitude and the total solar radiation on a horizontal plane. With these curves, the direct and diffuse components can be determined for any measurement of total radiation on a horizontal plane, if the solar altitude is determined for the time of the measurement. Total radiation is the usual measurement at Weather Bureau Stations. Fig. 11 shows this same ratio plotted against direct radiation on a plane normal to the sun's rays, I_{DN}, a measurement made at some stations. The curve was computed from the equation listed in Table 1

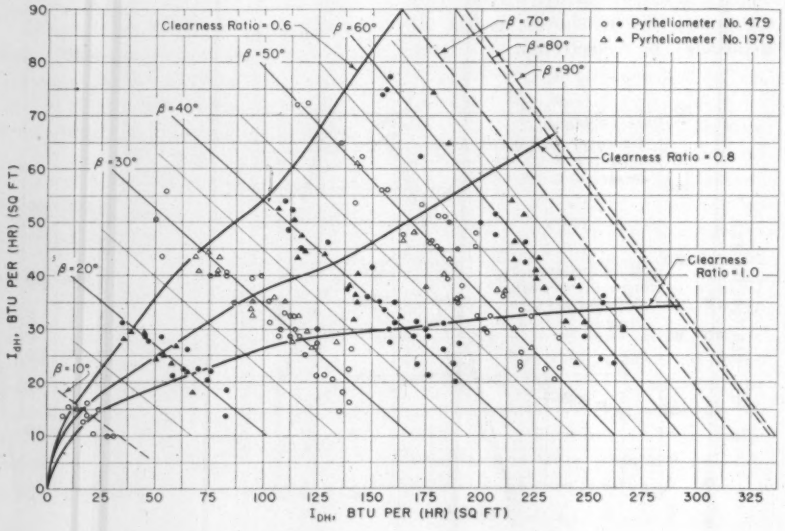


Fig. 8—Diffuse solar radiation, I_{dH}, on a horizontal surface *vs* direct radiation, I_{DH}, on a horizontal surface and solar altitude, β

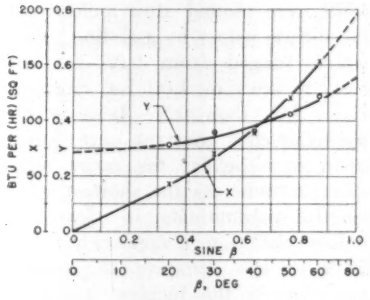


Fig. 9—Constants X and Y *vs* sine of solar altitude, β

and gives the diffuse radiation with an accuracy of about 5 percent.

Vertical Surface Values: Vertical surfaces introduce another parameter in addition to solar altitude and atmospheric clearness, namely the wall solar azimuth angle, γ (see Fig. 7). Vertical surface values for cloudless skies were plotted with clearness ratio as abscissa for altitude intervals of 10 deg and azimuth intervals of 10 deg up to $\gamma = 75$ deg and for larger intervals at greater values of γ. Curve families for each altitude interval were drawn and of these Fig. 12 for the 40 to 50 deg interval of solar altitude is typical. Because of the large number of variables to be covered, considerable interpolation was necessary despite the fairly extensive data collected.

From these curves and cross plots of these curves, curve families of vertical surface radiation, I_{dV}, were plotted against altitude for constant clearness ratios as shown in Fig. 13. With the aid of data of the type illustrated by Fig. 5, these curves were extrapolated to an altitude of 90 deg, for which vertical surface radiation would be the same for all orientations.

Discussion of Results

Atmospheric Absorption and Scattering: The data which have just been presented show that a fairly well defined relationship exists between the clearness of the atmosphere and the direct and diffuse components of solar radiation for a given solar altitude and surface orientation. The atmospheric clearness or turbidity has been defined in this paper as the ratio of the observed intensity of the direct beam of solar radiation on a plane perpendicular to the rays to the value[10] for a standardized atmosphere for the same altitude of the sun. This ratio has the great merit of simplicity and definiteness in describing the condition of the cloudless sky. It does not, however, take into account whether the direct beam is depleted by absorption or by scattering. This point will now be examined.

Depletion of the direct beam in a cloud-free sky is due to absorption and scattering. Ozone in the upper atmosphere and water vapor are the principal absorbing media. In all probability solid particles suspended in the air absorb to some extent. These elements plus the air molecules themselves scatter solar radiation. If it be assumed that atmospheric dust scatters but does not absorb, it is apparent that the intensity of diffuse radiation, directly proportional to scattering but reduced by absorption, can be expected to vary for the same intensity of the direct beam. The data shown in Fig. 8 have not been examined with this in mind, but it seems likely that the manner in which the direct beam has been depleted is responsible in part for the scatter of the data.

Table 1—Constants[a] for Diffuse Radiation on a Horizontal Plane for the Equation:

$$I_{dH} = X - YI_{DH}$$

Column A Solar Altitude β, deg	Column B X	Column C Y	Column D I_{DN} when $I_{dH} = 0$
10	(20)	(0.295)	(396)
20	42.7	0.314	(397)
30	70.4	0.360	(391)
40	90.1	0.362	(387)
50	121.4	0.424	(374)
60	153.6	0.492	(360)
70	(175)	(0.520)	(358)
80	(192)	(0.545)	(358)
90	(198)	(0.560)	(354)

[a]Values in parentheses determined by extrapolation.

Sources of Error: A certain amount of scatter can be attributed to experimental error. Some errors, however, such as improper shading of the pyrheliometer to obtain diffuse values, and chart reading errors, particularly at low intensities of diffuse radiation, are minimized in plotting. If the diffuse value is too high, then the direct radiation values, which are obtained from the difference between the total and dif-

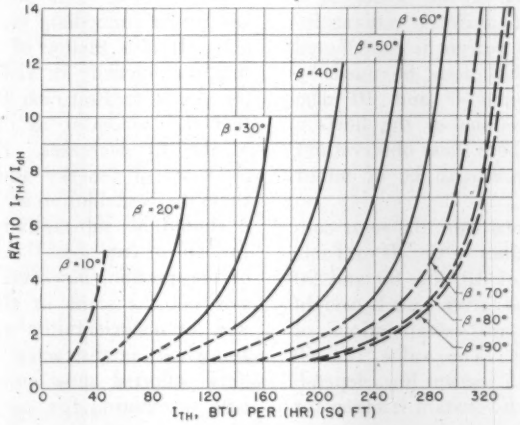


Fig. 10—Ratio of total to diffuse solar radiation on a horizontal surface *vs* total radiation, I_{TH}, on a horizontal surface and solar altitude, β

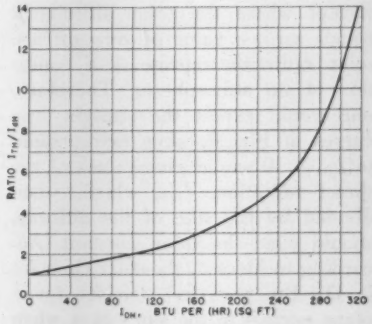


Fig. 11—Ratio of total to diffuse solar radiation on a horizontal surface *vs* direct radiation, I_{DN}, on a surface normal to the sun's rays

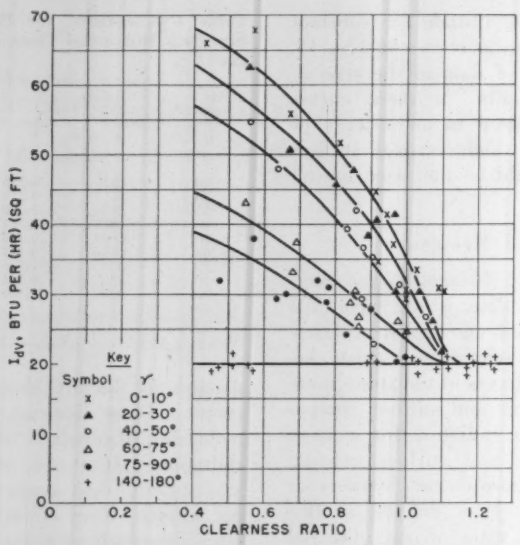


Fig. 12—Diffuse solar radiation, I_{dv}, on a vertical surface *vs* clearness ratio and wall solar azimuth, γ, for solar altitudes between 40 and 50 deg

fuse emfs, will be too low. Hence, the point is simply shifted along the curve without much change in relative position. Other factors do affect the relative position of the plotted points. One is the presence of unreported clouds and a second is abnormal reflection effects from surroundings. A third pertains mainly to horizontal surface values. To obtain these values for a given solar altitude, the diffuse radiation value usually required interpolation in the chart record. The value so obtained may not always have been typical of the sky conditions at the time the total radiation value was observed.

Horizontal Surface Observation: Except where the solar altitude β equals zero, a value of zero diffuse solar radiation represents a condition of no atmosphere. Therefore, one would expect the straight line curves of Fig. 8, when extrapolated to $I_{dH} = 0$ would give values of the direct radiation, I_{DH}, which, when divided by the sine of the altitude, should yield the solar constant. According to Moon[10], the solar constant is 419 Btu per (hr) (sq ft) for a plane normal to the sun's rays when the earth is at its mean distance from the sun. The Smithsonian scale of pyrheliometry puts the constant about 3 percent higher or 429. A value of 410 is obtained when Moon's constant is corrected for the mean distance corresponding to the period represented by the bulk of the data. The extrapolated values are listed in Table 1.

The fact that the extrapolated values are of the same order of magnitude as the solar constant suggests that the mean curves represent a relationship that is general and hence applicable with reasonable accuracy to other locations. It can be shown that of the total radiation incident on a unit area at the center of a hemisphere of uniform radiant intensity, only 3 percent is contributed by the spherical zone bounded by altitudes between 0 and 10 deg. Hence, obstructions of the horizon at the point where these observations were made appear to be of minor importance.

The deviations from the solar constant of the values in Col. D of Table 1 for angles of 10, 70, 80 and 90 deg cannot be given much weight because they are extrapolations of extrapolations. The value for 60 deg is 12 to 15 percent low, depending upon which constant is taken for comparison.

It will be recalled that the data obtained with pyrheliometer No. 1979 were plotted after multiplying the diffuse values by a sliding factor which ranged from 0.85 for the clearest skies to 1.00 for clearness ratios less than 0.5. Because the pyrheliometer constants are based upon response for the entire solar spectrum whereas the shortest wave lengths predominate in clear sky diffuse radiation, it appears that No. 1979 is less sensitive to spectral variation in the incident radiation and hence may register diffuse solar radiation more accurately. These two points suggest that the slopes of the curves, especially at the higher values of β, should be decreased, that is, the No. 1979 values uncorrected would be more nearly correct.

Since there are insufficient data to be conclusive, no adjustment seems warranted at this time. Further study of the response of this type of instrument with respect to diffuse radiation seems desirable.

A partially cloudy sky will greatly increase diffuse radiation values by reflection without impairing the intensity of the unobstructed direct rays of the sun. Curves similar to those of Fig. 8 may possibly be found to apply to skies of different degrees of cloudiness.

Vertical Surface Values: Interpretation of the vertical surface values requires consideration of three components of diffuse radiation, (1) ground reflected radiation, (2) radiation from the sky vault, and (3) radiation from that portion of the sky in the immediate vicinity of the sun. It is a matter of observation that the intensity of radiation from the sky is greatest near the sun, and that this increases as the clearness of the sky decreases. For a given clearness of the sky and solar altitude, the contribution of items 1 and 2 should be substantially the same for all orientations. At the point of observation, however, the terrain was not the same in all directions and for no orientation was the horizon wholly unobstructed. Hence, the data collected show some variation with orientation for the same value of γ.

The data of Fig. 6 show that with clearness ratio and solar altitude ap-

proximately constant, the vertical surface diffuse radiation decreases as the wall solar azimuth γ increases, slowly at first and then more rapidly. In this particular case, the component from the vicinity of the sun is small so that one would not expect the intensity to change much for angles greater than $\gamma = 90$ deg. The fact that I_{dv} does decrease continually until γ equals about 140 deg is probably due to the fact that, in this case, the effect of obstructions on the horizon increased as γ increased.

The curve family of Fig. 12 shows clearly the influence of component three, the radiation from the vicinity of the sun. The intensity of this component is proportional to the cosine of the incident angle, θ, and since $\cos \theta = \cos \beta \cos \gamma$, $\cos \theta$ decreases as γ increases. The figure shows that this component is substantially zero when the clearness ratio is about 1.1, that is, the sky is everywhere of uniform intensity, and that it increases as the clearness ratio decreases. Curves like those of Fig. 12 show, for γ greater than 130 deg, that I_{dv} is unaffected by clearness of the sky when β does not exceed about 45 deg. This is apparently due to the fact that as the sky vault component increases the ground reflected component decreases. Further, one would expect that for a given altitude, I_{dv} would be the same for all values of γ greater than 90 deg. The data show this is true for high clearness ratios and all values of β. For low clearness ratios, however, there are no data to show what happens when β is greater than 45 deg, but it has been assumed that the total value of I_{dv} for angles greater than $\gamma = 90$ deg increases as clearness ratio decreases. Hence, for clearness ratios of 0.6 and 0.8 estimated curves have been drawn in Fig. 13 for values of γ intermediate between 90 and 180 deg.

Practical Applications

Within the limitations of present day solar radiation instrumentation and more extensive tests or refinements, the relationships developed in Fig. 8 for horizontal surfaces appear to have general practical value. Though the data as presented for vertical surfaces apply only to the specific location, they can be applied to other surroundings, first, by making a correction for different ground reflectance, and second, by making allowances for different horizon obstructions. The correction for ground reflected radiation, I_G, is:

$$I_G = 0.5\ (I_{dH} + I_{DH})\ (\rho_e - 0.10),\ \text{Btu per (hr) (sq ft)} \quad \ldots\ldots\ldots\ldots (2)$$

where

ρ_e = the ground reflectance expressed as a decimal.

The correction for horizon obstruction can only be roughly approximated. It is estimated that the I_{dv} values for a surface viewing an unobstructed horizon would be greater by an amount equal to 0.15 times the diffuse values for γ greater than 90 deg for clearness ratio = 1.0. For clearness ratios of 0.6 and 0.8, the correction is 0.15 times the values for γ greater than 130 deg.

No allowance seems necessary for the small horizon obstruction in the case of the horizontal values presented. However, in some cases it may be found necessary to make some reduction in horizontal diffuse values because of partial shading of the sky by trees or tall buildings.

Diffuse values can be estimated if the solar altitude and either the total solar radiation on a horizontal plane, I_{TH}, or the direct normal radiation, I_{DN}, are known. If neither is known, the latter can be estimated from data given by Klein[9]. *Examples 1* and *2* will illustrate the use of the data.

Example 1: Find the diffuse solar radiation incident on a horizontal surface and on vertical surfaces facing east, south and west at 2 p.m. on August 1, 40 deg

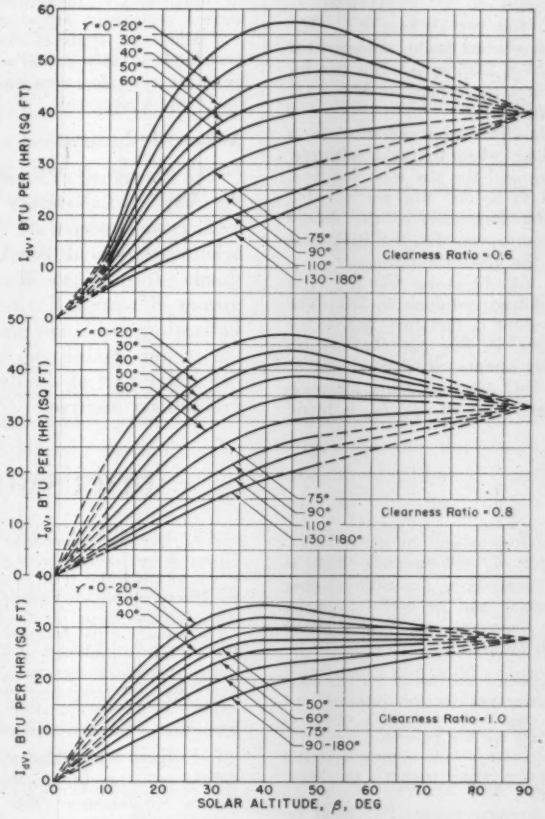


Fig. 13—Diffuse solar radiation, I_{dv}, on a vertical surface *vs* solar altitude, β, and wall solar azimuth, γ

north latitude. The atmospheric clearness ratio is 1.0 and ground reflectance, ρ_e = 0.20; the horizon is unobstructed.

Solution: In Chapter 13, of THE GUIDE 1954, Table 6 gives the solar altitude, β, and wall solar azimuth, γ. For this example β is 56.0 deg. The values of γ as tabulated apply only to times when the sun strikes the vertical surface. Therefore, γ for the south and west walls at 2 p.m. is 59 deg and 31 deg respectively, while γ for the east wall at 2 p.m. is 180 deg minus the value for the west wall at the same time or 149 deg.

From Fig. 8, I_{dH} is found to be 33.0 Btu per (hr)(sq ft), corresponding to $I_{DH} = 231$. I_{DH} may also be found by multiplying 279, (the value of I_{DN} in Table 4 of Chapter 13, THE GUIDE 1954) for 56 deg altitude and a clear atmosphere (Moon's values) by 0.829, the cosine (from Table 5, Chapter 13, THE GUIDE, 1954) of the incident angle for a horizontal surface. The total radiation on a horizontal surface, I_{TH}, is 231 + 33 or 264 Btu per (hr)(sq ft).

The vertical surface values of diffuse radiation are found from Fig. 13 to be 22.0, 26.5, and 31.0 for east, south and west facing walls respectively. According to Equation 2, the correction for ground reflection is 0.5 (264)(0.20 − 0.10) or 13.2 Btu per (hr)(sq ft). The approximate correction for an unobstructed horizon is 0.15 x 22.0, or 3.3 Btu per hr, so that the corrected values are 38.5, 43.0, and 47.5 respectively.

Example 2: The total radiation on a horizontal plane when the solar altitude, β, was 60 deg and the sky was cloudless, was observed to be 260 Btu per (hr)(sq ft). Find the magnitude of the diffuse and direct components for the horizontal surface and the clearness ratio.

Solution: Fig. 10 shows that the ratio of total to diffuse radiation is 5.1. The diffuse component is therefore 260 ÷ 5.1 or very closely 51 Btu per (hr)(sq ft) and the direct component is 260 − 51 or 209 Btu per (hr) (sq ft). For a clearness ratio of 1.0 and β = 60 deg, I_{DH} is found from Fig. 8 to be 245 Btu per (hr)(sq ft). Therefore, in this example the clearness ratio is 209 ÷ 245 or 0.85. Diffuse radiation values for vertical surfaces can be found for this clearness ratio by the procedure illustrated by *Example 1.* However, interpolation in Fig. 13 will be required. This illustrates how these procedures are applied to the usual observations of solar intensity made by the U.S. Weather Bureau.

Conclusions

1. Observations of solar radiation intensities on horizontal and on variously oriented vertical surfaces under conditions of cloudless skies have been analyzed. Relationships between the intensity of the direct and the diffuse components have been developed and expressed in terms of atmospheric clearness and position of the sun.

2. Based upon these observations, curves have been drawn which permit an estimate to be made of the diffuse solar radiation incident upon a horizontal surface or on a vertical surface of any orientation, if the solar altitude and either the total or the direct radiation on a horizontal surface are known. Methods of making corrections to the values for vertical surfaces for differences in ground reflectance and horizon obstruction are given.

3. Additional study of the relationships developed in this paper with data collected at other locations and under other conditions is suggested.

Acknowledgment

The assistance of many persons of the ASHVE Laboratory staff in collecting and preparing the data is acknowledged with thanks. Special thanks are due to W. W. Aubele, former Research Engineer, ASHVE Laboratory, who was associated with the writer during the collection of the major part of the data and some preliminary analyses.

References

1. ASHVE Research Report No. 1399 — Heat Flow Through Unshaded Glass: Design Data for Use in Load Calculations, by G. V. Parmelee and W. W. Aubele (ASHVE TRANSACTIONS, Vol. 56, 1950, pp. 371-398).

2. ASHVE Research Report — Design Data for Slat-Type Sun Shades for Use in Load Estimating, by G. V. Parmelee and D. J. Vild (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, September 1953, pp. 130-136).

3. Variations in the Total and Luminous Solar Radiation with Geographical Position in the United States, by H. H. Kimball (*Monthly Weather Review*, Vol. 47, No. 11, November 1919, pp. 769-793).

4. Insolation on Clear Days at the Times of the Solstices and Equinoxes for Latitude 42° N, by I. F. Hand (*Heating and Ventilating*, Vol. 47, No. 1, January 1950, pp. 92-94).

5. Measurements of Diffuse Solar Radiation at Blue Hill Observatory, by I. F. Hand and F. A. Wollaston (*U. S. Weather Bureau Technical Paper, No.* 18, Washington, D. C., May 1952).

6. Solar Radiation on Cloudless Days, by S. Fritz (*Heating and Ventilating*, Vol. 46, No. 1, January 1949, pp. 69-74).

7. Solar Radiation at Kew Observatory, by J. M. Stagg (*Meteorological Office Geophysical Memoirs No.* 86, H. M. Stationery Office, London 1950).

8. Insolation on Cloudless Days at the Time of Solstices and Equinoxes, by I. F. Hand (*Heating and Ventilating*, February 1954, pp. 97-100).

9. Calculation of Solar Radiation and the Solar Heat Load on Man, by W. H. Klein (*Journal of Meteorology*, Vol. 5, No. 4, August 1948, pp. 119-129).

10. Proposed Standard Solar Radiation Curves for Engineering Use, by P. Moon (*Journal of the Franklin Institute*, Vol. 230, No. 5, November 1940, pp. 583-617).

DISCUSSION

T. H. MACDONALD and SIGMUND FRITZ, Washington, D. C. (WRITTEN): This is an excellent analysis of the authors' data in a form which will be useful to many people. Our comments, mostly of a minor nature, are as follows:

1. Mr. MacDonald has found that measurements with Eppley pyrheliometers mounted in a vertical plane are likely to indicate values of radiation that are too low by 4 or 5 percent.

2. When the solar altitude is zero, there still is diffuse radiation which represents the beginning of twilight.

Qualitative reasoning suggests that linear extrapolation in Fig. 8 might not be quite correct in order to find the solar constant. It would be expected that the extrapolation would be curvilinear in such a way as to give larger values of the solar constant than those given in Table 1. The curvilinear effect would probably not be large, however.

The reason for the deviation of pyrheliometer No. 1979 is certainly not obvious; however, if spectral response is the cause, might it not be more likely that instrument No. 1979 is *more* sensitive to spectral variation since it differed from three other pyrheliometers?

I. F. Hand has published an analysis of diffuse radiation in the *Monthly Weather Review* for February 1954. In general the range of diffuse radiation values is not as great as the Cleveland values. A brief analysis of Mr. Hand's data indicates that it would corroborate the authors' Fig. 8 quite well for a solar altitude of 30 deg. For a solar altitude of 60 deg, Mr. Hand's data give about 20 percent higher values of diffuse radiation for a given direct radiation.

L. R. Phillips, Hartford, Conn., inquired whether any measurements had been taken to show the actual temperature rise of the glass. He also asked whether determination had been made of the radiant effect of walls of adjacent buildings or other

surfaces that might absorb radiation and radiate to the glass.

T. F. Malone, Cambridge, Mass., stated that meteorologists had followed with considerable interest the Society research papers on heat flow through glass. He stated that absorption of diffuse radiation by water vapor can be as much as 10 to 15 percent. A brief examination of the weather maps for the days on which the values in Fig. 3 were obtained shows that there was a considerable difference in the precipitable water in the atmosphere. He pointed out that the type of analysis presented in the paper could be extended to an analysis of direct and diffuse radiation on other than cloudless days. Observations made by Messrs. Kimball and Hand in the *Monthly Weather Review*, Vol. 50, pp. 615-628, 1922, might provide an interesting check on the variation of diffuse radiation with the vertical wall azimuth. Professor Malone inquired whether Mr. Parmelee had compared his results with the diffuse radiation measurements made at Blue Hill Observatory.

Commenting on pyrheliometer No. 1979, Professer Malone felt that the instrument was probably more sensitive to spectral variations in incident radiation than the other instruments used.

R. C. Edwards, Pompton Plains, N. J., asked the author how the total radiation for any given set of conditions varied with the clearness ratio.

R. W. McKinley, Pittsburgh, Pa., stated that it might be possible to use available Weather Bureau data and the clearness ratio concept for the purpose of plotting the curve showing the effect of cloudy sky (due to reflection of the diffuse radiation values).

Austin Whillier, Cambridge, Mass., pointed out that those interested in solar heat collectors are dealing with a surface which is tilted rather than horizontal or vertical. The graphs presented in the paper for horizontal and vertical diffuse radiation provide a means for making a good estimate of the diffuse radiation reaching a tilted surface. In order to make the calculation it would be necessary to proportion the allowance from the horizontal and vertical values by weighting according to the sine or cosine of the angle of tilt (with the vertical) of the receiving surface.

AUTHOR'S CLOSURE: Mr. Parmelee stated, with reference to Mr. Phillips' question, that the temperature of glass surfaces had been reported in previous papers on heat transfer through glass. It had not been possible to make allowance for reflection from neighboring building surfaces except to determine light reflection measurements from the test house roof.

In reply to Professor Malone, Mr. Parmelee stated that for these tests he was primarily interested in diffuse radiation as obtained on cloudless days. He referred to the work of Professor Malone which had provided a good analysis of diffuse radiation from cloudless skies. With regard to the effect of water vapor, Mr. Parmelee felt that a study of its effect from the Weather Bureau data would undoubtedly be worthwhile. While the author had not had an opportunity to make a careful check of the values of horizontal diffuse radiation as compiled by Mr. Hand, he felt that the results of both investigators were quite consistent. It was pointed out that the results obtained by Mr. Hand were obtained mainly on very clear days, and that such days were not usual in Cleveland. It was suspected that the variation in readings obtained by one of the pyrheliometers was due to the fact that the coatings used were not equally sensitive to all wave lengths.

In answer to Mr. Edwards, it was stated that with a clearness ratio of about 0.7 the total radiation received was approximately 25 percent lower than with a clearness ratio of 1.0.

Edge Insulation of Concrete Slab Floors

In order to determine the effectiveness of edge insulation in preventing the cooling of concrete floor slabs on ground near exposed walls, the National Bureau of Standards has tested nine concrete floor slab sections adjacent to a cold wall and determined the floor surface temperature for conditions of 70 F indoors and either 32 or zero F outdoors.

The exposed edges of the several specimens were insulated in different ways to determine the effect of eight methods of edge insulation on floor-surface temperature and the possibility of condensation. With a simulated outdoor temperature of about 0 F, the temperature of the floors with edge insulation was found to range from 9 to 13 deg higher at a point 1 in. from the cold wall and the average temperature of the 30-in. border next to the cold wall was from 3 to 5 deg higher than that of the floor without edge insulation. The tests showed that condensation, which probably would occur on uninsulated floors under certain conditions, can be prevented with edge insulation.

Temperatures in the warm compartment were measured with copper-constantan thermocouples placed in a vertical plane passing through the center line of each floor specimen at various selected levels ranging from 30 in. above floor level to 40 in. below floor level. Cold compartment measurements were made with the same type of thermocouple in the air space close to the edge insulation, at ground level, and at selected points down to 28 in. below ground level.

The results also revealed that the temperature in the cold space had very little effect on the floor-surface temperatures at distances greater than 38 in. from the exterior wall. However, the effect of the cold space temperature was significant at a distance of 14 in. from the exterior of the cold wall.

When the cold space temperature was maintained at 0 F this temperature difference ranged from 4.1 deg to 5.8 deg for the insulated floors and was 9.1 deg for the uninsulated specimen. Of the insulated floors, the slab insulated with a vertical piece of rubber board 2-in. thick and 18-in. deep had the warmest border and the specimen with fiberboard ¾-in. thick at the slab edge and between slab and footing had the coldest border.

The floor-surface temperature near the interior of the cold wall was of particular significance insofar as surface condensation on the floors was concerned. Condensation was observed on the floor with the uninsulated edge, but did not occur on any of the floors with insulated edges. The floor surface temperature observed at the edge of the uninsulated floor when the cold space temperature was 0 F was such that condensation would occur for relative humidities above 44 percent in a 70 F room. Condensation would not have occurred on the poorest of the insulated floors until a relative humidity of 59 percent was reached in a 70 F room under corresponding cold space temperatures.

Elmer R. Kaiser
New ASHVE Research Director

Elmer R. Kaiser

The appointment of a new Director of Research for THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has just been announced by L. N. Hunter, President, at Society headquarters, 62 Worth St., New York, N. Y.

Elmer R. Kaiser, Columbus, Ohio, was appointed to the post by the ASHVE Council and will enter upon his new duties about September 1. Since his graduation from the University of Wisconsin with a B.S. and M.S. in Mechanical Engineering in 1934, he has been actively engaged in research work particularly in the field of fuels and during the past 20 years served on the staff of Battelle Memorial Institute, and with Bituminous Coal Research as assistant to the president, assistant director of research, general manager of BCR Products, Inc., and associate director of research in charge of the BCR Laboratory at Columbus.

Mr. Kaiser was born in New Holstein, Wis., in 1909 and attended the University of Wisconsin. He was a pupil of the late Prof. Gustus L. Larson, past president of the Society. He is a licensed professional engineer in the State of Ohio and the Commonwealth of Pennsylvania and is a member of the honorary fraternities, Tau Beta Pi, Pi Tau Sigma and Phi Eta Sigma.

In his professional work, Mr. Kaiser has had wide administrative experience, planning and supervision of research programs, and has written extensively on subjects dealing with combustion, heat generating equipment, air pollution and the utilization of coal.

Mr. Kaiser holds membership in *ASME, AIME* and has served as chairman or member of *ASME* Fuels Division, *AIME* Committee on Research, *AIME-ASME* Joint Fuels Conference, *ASME* Power Test Code Committee 16, *ASME* Columbus Section Executive Committee, Air Pollution Control Association and also as a Trustee of the Central Ohio Technical Foundation and is listed in *Who's Who in Engineering.*

In making this important announcement, Pres. Hunter and R. S. Dill, chairman of the ASHVE Committee on Research, feel confident that Mr. Kaiser is eminently qualified to carry on a comprehensive program of research dealing with all phases of heating, ventilating, cooling and air conditioning which will be of service to the membership and the general public. He brings the experience of many years of research planning and general administrative and advisory work, which will insure the desired expansion of the Society's research program and will contribute materially to the development of useful scientific knowledge for all those concerned with the advancement of the heating, ventilating and air conditioning profession.

The Officers and Membership of ASHVE welcome Mr. Kaiser to his new post and wish him every success in meeting the challenges of this rapidly growing field of engineering.

Mr. Kaiser will make his headquarters in the ASHVE Research Laboratory, 7218 Euclid Ave., Cleveland, Ohio.

Should ASHVE Change Its Name?

DEAR MEMBERS:

Should ASHVE change its name? Council feels it should and at the recent Semi-Annual Meeting at Swampscott, authorized taking the necessary steps to change the name of our organization to AMERICAN SOCIETY OF AIR CONDITIONING ENGINEERS.

This action will not surprise many of our members. For many years there have been frequent discussions by groups and committees of the possibility and advisability of changing our name. It should be understood, however, that Council action does not make the name change an accomplished fact. This action does get the matter before the entire membership of the Society for discussion, consideration and eventual adoption or rejection.

It is likely that the subject will be discussed at many Chapter meetings this fall and will be brought up for final action at the next Annual Meeting of the Society in Philadelphia next January. If you are not present at the meeting in person to vote you will have an opportunity to vote by proxy.

The membership may reject Council's suggested name and may adopt a different one, such as, for example, AMERICAN SOCIETY OF HEATING AND AIR CONDITIONING ENGINEERS, or it may prefer to retain our present name. In any event every voting member of the Society will have an opportunity to approve or reject the change.

When our Society was organized in 1894 heating and ventilating represented our most important field of interest. However, for many years now our profession and industry have been dealing with the subject of air conditioning of which heating and ventilating is only a part. Many of our members have felt that our present name does not adequately describe the scope of our present interests. The definition of air conditioning as given in our Guide is as follows:

> The simultaneous control of all, or at least the first three, of those factors affecting both the physical and chemical conditions of the atmosphere within any structure. These factors include temperature, humidity, motion, distribution, dust, bacteria, odors and toxic gases, most of which affect in greater or lesser degree human health or comfort.

Air conditioning is surely of vital interest and an essential function of that part of industry and the engineering profession represented by our Society more than it is of any other organization and we should identify ourselves more positively with it than we do with our present name. A number of other technical organizations in the mechanical, electrical, refrigeration and automotive fields are showing an increased interest in air conditioning. We welcome, of course, the expressed interest of other professional societies and technical groups in this broad subject. We favor any activity that advances, promotes and stimulates the art and science of air conditioning. It is a major activity of our Society, however, and we should be considered the most authoritative organization representing that field.

It can be argued that even the name of air conditioning does not describe fully the scope of our interest. Problems such as those relating to snow melting, heating domestic hot water, generation of steam for power and many others are not covered by the air conditioning definition. On the other hand air conditioning is a much broader subject than we may at first suppose. Problems involving the sizing of steam and hot water piping, the selection of boilers or pumps for a heating system, for example, are as equally related to air conditioning as the sizing of ducts, the selection of cooling coils or refrigeration apparatus, when the system is intended to control thermal environment for living and working space.

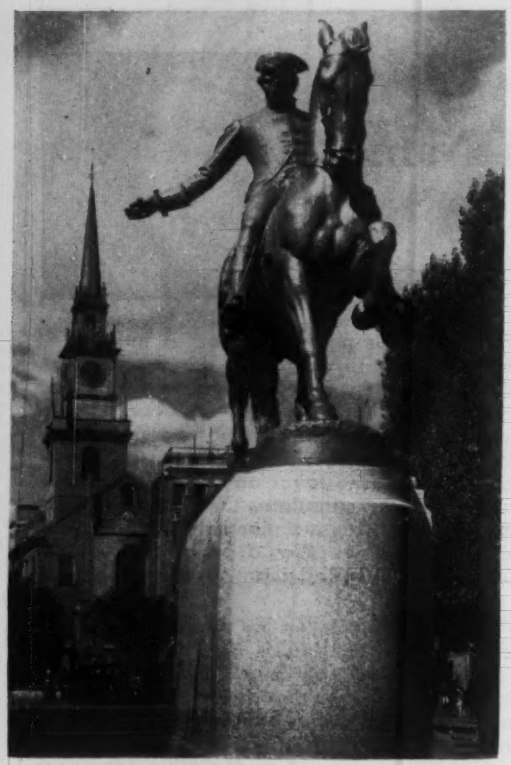
Our present name is well known, our accomplishments have enhanced our prestige, and as an organization we are highly regarded. We must assure ourselves that we will gain more than we lose by adopting a different name and that we will not destroy entirely our identity with ASHVE. Retaining the words AMERICAN SOCIETY in the new name should help in establishing in the mind of the public the relationship between the two names.

This is a very important step our Society is taking and we urge all members to consider it carefully and discuss it with your fellow members so that when final action is called for, you will be able to act with full knowledge and understanding of the implications involved.

Cordially yours,

L. N. Hunter

PRESIDENT



Paul Revere Mall with Old North Church in background

Swampscott Successful "Weather" or Not

ALTHOUGH THE weatherman did not fully cooperate, the well-rounded program of activities planned by the Massachusetts Chapter kept everyone busy.

A near record attendance was set at the Semi-Annual Meeting at the New Ocean House, Swampscott, Mass., June 28 to 30. The total was 568, made up of 287 members, 186 ladies, 56 guests and 39 children. Twenty-eight states and Canada were represented, top honors going to Massachusetts (121), New York (101), Pennsylvania (40), Michigan (31), and Canada (27).

The Committee on Arrangements was on hand from the time of the first arrivals on Saturday, June 26, until the departure of the last member on the following Thursday. General Chairman R. T. Kern, Vice Chairman A. L. Hare, Honorary Chairman L. E. Seeley, and the following subcommittee chairmen: *Banquet* — G. D. Fife, *Entertainment* — L. R. Geissenhainer, *Finance* — W. H. Shipp, *Ladies* — D. M. Archer, *Publicity* — J. MacG. Means, *Sports* — W. G. Burbo, *Reception* — G. W. Sprague, *Sessions* — John Bonner, and H. L. Farrow — *Transportation*, and all the various committee members deserve great credit for their effective preparation and organization of all events which provided both entertainment and instruction for those in attendance.

Serious work in promotion of the objectives of the Society was carried on in the four technical sessions and at meetings of the Council, Committee on Research and 10 Technical Advisory Committees, Guide Committee, Joint Committee for Preparation of Standards for Comfort Air Conditioning, Ways and Means Committee, the Chapters Conference Committee and the Nominating Committee.

FIRST SESSION, MONDAY, JUNE 28, 9:30 A.M.

Pres. L. N. Hunter called the meeting to order at 9:30 a.m. in the Ballroom of the New Ocean House, Swampscott, Mass. He reported that the Committee on Arrangements had made preparations for a very interesting meeting, and then introduced R. T. Kern, general chairman of the committee. Mr. Kern outlined the plans for the entertainment of the members, and expressed the hope that the return to Swampscott, after 17 years since the last meeting there, would be a thoroughly enjoyable occasion.

President Hunter expressed the thanks of the Society for the invitation to come to Swampscott.

The following Committee on Resolutions was appointed: I. W. Cotton,

Chairman, Indianapolis, Ind., B. L. Evans, St. Louis, Mo., J. H. Ross, Toronto, Ont.

First Vice Pres. John E. Haines presented a written notice of a proposed amendment to the Society By-Laws as follows:

Amend **Article VII,** *Section* 3 (*h*), paragraph 5 to read as follows:

The Committee on Research shall recommend to the Council for appointment a Director of Research whose activities, proceedings and reports shall be subject to the direction of the Committee and the approval of the Council. The salary of the Director of Research shall be fixed by the Council upon the recommendation of the Committee on Research, and his employment may be terminated in the Council's discretion.

Mr. Haines explained that the purpose of this change was to eliminate the restriction which requires that the Committee on Research recommend a Director each year for the approval of the Council. He stated that the proposed change would permit the Committee on Research to recommend to the Council a Director of Research with an undetermined period of employment, thereby eliminating the necessity for annual reappointment.

On motion of First Vice Pres. Haines, duly seconded, it was voted that the proposed amendment be presented to the Society at the 61st Annual Meeting at Philadelphia for action.

President Hunter informed the members present that consideration had been given in the Council to change the Society's name to AMERICAN SOCIETY OF AIR CONDITIONING ENGINEERS. He stated that further publicity would be given to this suggestion, and that ample opportunity would be given to the membership to discuss the matter fully before any action with regard to adoption of the new name would be taken (see President's letter p. 139).

President Hunter introduced Nathaniel Glickman as chairman of the first technical session.

R. T. Kern, general chairman of Committee on Arrangements, addressing members at technical session, with G. L. Tuve, as session chairman

Mr. Glickman read the rules for professional sessions, and announced that the first paper, Physiological Responses to Sudden Changes in Atmospheric Environment: Studies of Normal Subjects, Obese, Hyperthyroid and Hypothyroid Patients, by Tohru Inouye, F. K. Hick, M.D., R. W. Keeton, M.D., and Lionel Bernstein, M.D., (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1954) would be presented by Dr. Hick.

Abstracts of discussions are as follows:

W. A. Grant, Syracuse, N. Y., observed that according to the paper many people who would seem to deviate physically from the normal still were able to adjust quite readily to sudden changes in environmental conditions. He inquired whether the authors could state the degree of rectal temperature rise which would indicate that air conditioning would be needed to make people comfortable. He also asked whether the percentage of hyperthyroid individuals in the total population was known.

H. E. Ziel, Detroit, Mich., mentioned that industry is disturbed by the accident rate which is found in hot industries. He inquired whether it would be possible to establish the maximum temperature to which an employee could be subjected without harm, or whether a time limit could be established for exposure to temperatures above the maximum allowed for continuous exposure.

C. S. Leopold, Philadelphia, Pa., pointed out that this paper, as well as others from the same source, proved that air conditioning produced no harmful effects on occupants. It was also evident, he stated, that it is not necessary to maintain some fixed relation between indoor and outdoor temperature.

R. W. McKinley, Pittsburgh, Pa., suggested that information on the physiological effects of sudden changes upon children should be investigated.

Austin Whillier, Cambridge, Mass., inquired whether the subjects under test engaged in reading or any other mental activity.

W. M. Wallace II, Durham, N. C., stated that there seemed to be differences in opinion regarding the proper temperatures for operating rooms in hospitals. He asked whether Dr. Hick could suggest the proper temperature to be used in an operating room having a relative humidity of 55 percent.

R. A. Miller, Pittsburgh, Pa., requested information on the method of measuring the moisture absorbed by the clothing.

C. M. Humphreys, Cleveland, Ohio, expressed the hope that since the present series of tests was now completed at the University of Illinois, some related investigation could be instituted to provide further information on physiological reactions.

Chairman Glickman emphasized the finding of the authors that hyperthyroid patients had a greater evaporative heat loss than normal subjects. He mentioned that Newburgh and others have shown a direct relationship of insensible perspiration and basal metabolism. The hyperthyroid patients had a metabolic rate about 44 percent higher than normal subjects, according to the experiments reported in this paper. He stated that Table 2 should show whether it was statistically significant that hyperthyroid subjects, during three-hour exposures, showed persistently higher mean skin temperatures than normal women. For short exposure the difference between these two groups did not appear to be significant.

From an examination of Table 3, Chairman Glickman questioned the statement that hyperthyroid women showed the most rapid rise in skin temperature. He thought it more likely that normal subjects had a more rapid rise during the first 10 minutes in the hot room. It did seem important, however, that the rectal

Guide Committee plans 1955 Guide (*standing l.* to *r.*) P. R. Achenbach, W. M. Wallace, II, A. T. Jones, Albert Gianinni, Carl H. Flink, J. F. Sandfort and A. A. Marks, with R. E. Cherne, chairman

temperature of the hyperthyroid subjects rises more than that of normal subjects. It indicated a storage of heat, and that the subjects had developed a fever at the end of the hour in the hot room, with temperatures above 99.6 F, at which the oxygen consumption or heat production as well as cardiac output would increase. This was indicated by the authors' report that five hyperthyroid patients could not endure the hot room conditions for more than 30 minutes.

It seemed to Chairman Glickman that there were errors in the Table 3 averages for time of onset of physical sweating for all four groups, if these averages were based on Table 4 values.

Chairman Glickman explained the slower cooling of the skin of hypothyroid and obese subjects as compared with normal subjects by assuming that in both of these groups the subject had significantly less moisture available for evaporation than normal subjects when returning to the comfortable room from the hot room.

In the case of the hyperthyroid patients, Chairman Glickman emphasized that this group and the normal subjects had the same amount of moisture available for evaporation on entrance into the comfortable room. The mean skin temperatures of both groups, however, responded similarly in the comfortable room. He explained the increased heat loss by evaporation of the hyperthyroid subjects by assuming that the fever developed in the hot room caused an increase in the already high heat production and cardiac output of the hyperthyroid subject. The higher production of heat increased the amount of evaporation which was accompanied by lowering of rectal temperature.

Chairman Glickman concluded that the main results of the paper indicated that except for the effect of heat on hyperthyroid patients, the physiological adjustments of the subjects to sudden changes in physiological environment occurred rapidly and with relative ease.

R. C. Edwards, Pompton Plains, N. J., inquired whether the mean skin temperature of the hyperthyroid subjects, which dropped below that of the others when going from the hot room to the cold room, would have risen above that of the other subjects if the test had been conducted for an additional two hours.

AUTHOR'S CLOSURE (F. K. Hick, M.D.): Dr. Hick stated that the percentage of hyperthyroid persons in the population is very small, and would have no importance outside of hospital populations.

He stated that the authors had not determined the rise in rectal temperature that would warrant special efforts to make people comfortable. People seem to be willing to endure considerable environmental changes in their daily living.

Referring to Mr. Ziel's question, Dr. Hick suggested that perhaps the experiments being conducted by Dr. T. F. Hatch would yield information on the limiting time for exposure to extreme heat. The author agreed with Mr. McKinley that tests on children might be interesting, but that such tests would be very difficult to undertake due to the activity of the subjects.

Dr. Hick, in reply to Dr. Whillier, stated that the subjects did not engage in any activity or mental exercise which would increase the production of sweat.

The suitable operating room temperature, in Dr. Hick's opinion, would seem to be that which would suit the surgeon. He pointed out that the patient is commonly covered by drapes and is exposed to an intense light, and commonly has five or six people standing at his side. He would therefore have great difficulty in losing body heat regardless of the dry-bulb temperature in the air conditioned operating room.

Dr. Hick mentioned that a normal suit of summer clothing transferred from the comfortable room to a room of 98 F and 66 percent relative humidity would very rapidly absorb an ounce or two of moisture, even though the suit were not being worn. In the tests the absorption or loss of moisture was obtained by the difference in the patients' weight loss.

In conclusion Dr. Hick remarked that for a long time it has been considered that subjects who have to sweat freely are subjected to some sort of physiologic stress. This assumption, however, has not been proved. It appears that as long as a subject can keep his rectal temperature from increasing, the environment is physiologic for him as he goes into higher environments. This does not apply to transfer to cooler zones. At the present time there apparently is no way to show what degree of heat first constitutes stress except the indication afforded by a rise in rectal temperature. An investigation is being made by Mr. Tohru Inouye to determine whether some chemical measurement of adrenal hormones can be used to indicate stress.

The second technical paper, A Rapid Heat Meter Thermal Conductivity Apparatus, by J. D. Verschoor and Ada Wilber, (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1954) was presented in abstract by Mr. Verschoor.

F. A. JOY, State College, Pa. (WRITTEN): The authors have shown large time savings by the use of heat flow meters and

have obtained consistent and satisfactory results for the objectives outlined. In many other ways heat flow meters provide a convenient and often the only way to obtain required information. Their use increases in spite of a widely-shared suspicion regarding their absolute accuracy.

The causes of inaccuracy merit more study. The authors' interpretation of their results, which show about 10 percent lower values than obtained with the *ASTM* guarded hot plate, would be very much valued.

Intrinsically, there is no reason why a properly designed heat flow meter should not be accurate when properly calibrated and properly applied as well. Many observers have reported that the meter response depends on the surface it contacts and that it must be calibrated *in place* or in a similar thermal environment. Some have noted the need for firm pressure or thorough sealing to the surface to which it is applied. These precautions appear necessary in some designs, especially when the meter encourages a nonuniform heat flux by metallic paths through the thermal resistance in its core or when it has no guard area surrounding the area covered by thermocouples.

I would like to ask more about the calibration method used by the authors, in particular whether both faces of the meter were on metal. This arrangement might allow a larger proportion of heat to funnel through the center, due to through metallic paths, than would be obtained later in usage with only one metallic contact. We prefer to calibrate such meters between twin boards previously tested together in a guarded hot plate, adding a metal contact surface if the meter must be so used.

I am sure that heat flow meters are going to be more widely used and improvements in their design will accompany the demand.

L. F. Schutrum, Cleveland, Ohio, inquired whether the movable plate was set at a fixed dimension from the stationary plate or whether its position was determined by the pressure of the plate on the sample of insulation.

Dr. Whillier referred to the statement in the paper that a slight error occurred in assuming that the difference in the emf obtained from thermocouples on both sides of the heat meter could be used to indicate the temperature differences between the surfaces of the meter. He suggested that the temperature could be determined accurately for the thermocouples on each side by proper calibration of the thermocouple material.

Another suggestion by Dr. Whillier was that a quarter inch thickness of insulation material or wood be placed between the heat meter and the plate upon which it is resting in order to reduce the temperature fluctuation on the surface which is in contact with the hot or the cold plate.

Dr. Whillier also suggested that the heat meter should be surrounded by a strip of the same material and thickness as the heat meter in order to provide a guard ring around the meter.

R. J. Mindak, Chicago, Ill., suggested that the heat meter should be applied on both sides of the insulating material being tested, thereby permitting the testing of greater thicknesses of insulation. This procedure would provide a measurement of the heat flow across both surfaces of the material.

AUTHOR'S CLOSURE (J. D. Verschoor): With reference to Mr. Schutrum's question, spacing blocks were used to insure proper distance between plates when testing compressible material. With noncompressible materials, the weight of the upper plate plus the insulation causes the heat meter to make proper thermal contact.

A guard ring as suggested by Dr. Whillier was included in the method used and was matched closely to the edges of the heat meter. This guard ring was made of material having the same thermal conductivity as the heat meter.

The authors had not found it necessary to test three-in. material since the conductivity could be determined from one inch slices of homogeneous material.

In the tests conducted it had been found that the time to establish equilibrium conditions was approximately 1½ hours.

Mr. Verschoor stated that a location of a heat meter on both surfaces had not been considered necessary because the small area for which the conductivity was determined was surrounded by the remainder of the sample which thereby provided a guard around the section under test.

In order to insure a minimum of fluctuation of the heat meter surface temperature, the authors had placed a meter in contact with the steam plate rather than a plate in which the temperature was maintained by tap water or electrical means.

Edward R. Snow tells members about the New England Coast at Welcome Luncheon

The third technical paper, Irradiation of Vertical and Horizontal Surfaces by Diffuse Solar Radiation from Cloudless Skies, by G. V. Parmelee, (see this issue, p. 129, discussion follows paper) was presented in abstract by the author.

Chairman Glickman turned the meeting over to President Hunter who read a telegram containing greetings from Past Society Pres. C. V. Haynes, and adjourned the meeting at 12:30 p.m.

SECOND SESSION, TUESDAY, JUNE 29, 9:30 A.M.

First Vice Pres. John E. Haines called the meeting to order at 9:30 a.m., and introduced G. L. Tuve as chairman of the second technical session. Chairman Tuve pointed out that one of the reasons for presenting papers at meetings was to obtain comments and discussions which would be helpful to the authors, and would increase the value of the papers. He urged the audience to express thoughts which occurred to them during the presentation of the papers.

The first technical paper was Characteristics of Downward Jets of Heated Air from a Vertical Discharge Unit Heater, by Linn Helander, S. M. Yen and L. B. Knee. An abstract of the paper was presented by Dr. Yen.

Discussions of the paper were presented by W. O. Huebner, New York, N.Y., W. A. Grant, Syracuse, N. Y., H. H. Yousoufian, New York, N. Y., I. S. Dane, Boston, Mass., Leonard Phillips, Hartford, Conn., Edward Berly, Waltham, Mass., W. M. Myler, Jr., Columbus, Ohio, H. E. Ziel, Detroit, Mich., R. C. Edwards, Pompton Plains, N. J. and Chairman Tuve (complete paper and discussions to be published in the ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*).

JOURNAL SECTION

Gilbert Merrill and friend *Spookie* at New England Shore Dinner

Children at Swampscott are all eyes as Gilbert Merrill shows live rattlesnake

Alfred Koestel presented his paper, Computing Temperatures and Velocities in Vertical Jets of Hot or Cold Air (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, June 1954).

W. O. HUEBNER, New York, N.Y. (WRITTEN): A paper* by G. L. Tuve, already published, gives a complete summary of present day studies on axial and radial jets. This information is now incorporated in Chapter 31 in THE GUIDE 1954.

Some equations given by Professor Tuve in his paper were used by G. E. McElroy to prepare two charts for the chapter, namely: (1) a chart for determining centerline velocities of axial and radial jets, and (2) a chart for entrainment ratios and straight flow outlets. These charts may be easily applied for the solution of practical air distribution problems.

However, all this information deals with non-isothermal jets only. Professor Koestel's paper, therefore, by its very title, excites the interest of the reader. I offer the following comments:

1. I am not in a position to judge whether Professor Koestel's simplifying assumptions are correct. The extremely low value of the parameter

$$D_o \Delta t_o \beta g / V_o^2$$

however, seems indeed to suggest that — as already pointed out in THE GUIDE — temperature and density differences have but small effect on cross-sectional velocity profiles of straight flow outlets.

2. I can also offer few figures to either affirm or contradict Equations 3 and 6. However, the equations check very well with the data of other investigators, and there seems to be no reason to assume that they are not valid for practical engineering purposes. It is particularly gratifying that Equation 9 so closely approximates the correlation equation derived by Linn Helander (Progress Report, Downward Projection of Heated Air, January 6, 1951).

3. To increase the value of Equations 3 and 6 for the practical engineer, they should be translated into charts. There arises, of course, the question as to whether these charts would differ greatly from the charts prepared by G. E. McElroy, the second element of Equation 3 being so small.

4. In addition to its main purpose of providing a basis for exploring the performance of non-isothermal jets, the paper adds to our general knowledge of jets. The characteristics of isothermal and non-isothermal have, to my knowledge, never been as clearly shown as in Figs. 2 and 3 of the paper. Also the whole method of analysis, though we may not be able to follow it in all its details, increases our understanding of the nature of ventilating jets.

5. Prof. Theodore Hatch of the University of Pittsburgh is studying the basic principles of local exhaust ventilation for hot industrial processes by investigating convection currents set up by hot bodies. In spite of the difficulties mentioned in Professor Hatch's Progress Report of December 1953, Professor Koestel's equations might be of use in Professor Hatch's investigation.

Linn Helander, Manhattan, Kans., stated that while he felt that the existence of similarity may be an acceptable simplifying assumption for long-throw jets in which the ratio of buoyant force to the momentum force is small, he was skeptical regarding its acceptability when the ratio of buoyant force to momentum force was not small.

Mr. Edwards, Pompton Plains, N. J., inquired why heat was dissipated faster than velocity in an air jet, especially since air conductivity is low.

AUTHOR'S CLOSURE: Professor Koestel, referring to Mr. Huebner's discussion, stated that he doubted whether the charts in the air distribution chapter of THE GUIDE, 1954, were applicable to non-isothermal jets.

Referring to Professor Helander's comment, the author referred to his data to show that similarity was found in a vertical jet of heated air in natural convection where the maximum ratio of buoyancy to momentum occurred. He therefore believed the similarity assumption would be valid for large buoyancy forces.

The author stated that he could not explain why heat and velocity diffused at different rates. The diffusion was obtained mainly by turbulent mixing in both cases.

Chairman Tuve introduced W. L. Rogers, who presented his paper, Sound-Pressure Levels and Frequencies Produced by Flow of Water Through Pipe and Fittings (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, July 1954).

H. C. HARDY, Chicago Ill. (WRITTEN): The author is to be highly congratulated for studying a very important problem and presenting information to the Society. I am very pleased that he introduced considerable modern technology into the paper; for instance, the frequency measurements in octave bands. It is an oddity that the first publication with modern acoustic measurement techniques in the JOURNAL of ASHVE should be on pipe noises rather than airborne noises with which members of the Society have worked so long, but it is understood that the latter technical information deficit will be reduced in the near future.

It should be emphasized that the data of Professor Rogers' paper are not yet ready to be put into use in practical engineering problems. These data apply only to sound pressure levels in the fluid in the pipe. They should not be confused in any way with sound pressure levels in the air around the pipe, with which there will be, in general, no simple correlation. As Professor Rogers indicates in his conclusion, it is still necessary for us to learn how the amplitudes of vibration of the pipes are related to the interior sound pressure levels and how the amplitudes of vibration create sound in the air by direct

*Air Velocities in Ventilating Jets, by G. L. Tuve (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, January 1953, p. 181).

coupling or by exciting through hangers the vibration of partition walls.

Previous work in the laboratories with which I am associated has shown conclusively that there is a strong coupling between the pipe vibrations and the interior sound pressure level. This coupling is so strong that a few feet from an excitation in the liquid, most of the energy is in the pipe itself. I suggest, therefore, that after the fundamental research relations are worked out by Professor Rogers and others, we depend principally on data determined by vibration measurements rather than on water coupled microphones. By this means the vibration data will be so much more conveniently obtained in both the laboratory and the field and will, I believe, be less susceptible to engineering errors.

It is interesting to observe from Professor Rogers' data that the noise level rises approximately as the fifth power of the speed. However, it appears that one would have to exceed 50 fps in order to obtain speeds (below cavitation) which would make the flow noise important. This is also almost the same situation that is found in air-flow systems.

It is hoped that this pipe noise research will be continued with the same dispatch as has been employed on this project thus far.

R. T. KERN, Boston, Mass. (WRITTEN): The experimenters on this project have done a great amount of work since they presented their first paper at Denver last year. However, it is my belief that much of the work now being done will be of little value to the designing engineer unless the trend of the studies is changed. I am under the impression that this work was authorized as a study to ascertain the causes of noise in hot water heating systems and to determine the steps necessary to prevent, or at least lessen, those noises. It was generally agreed, I believe, even before any tests were started, that the noise due to velocity in straight pipe was probably almost negligible and that the objectionable noises were probably caused by orifices and throttled valves used as controls.

Rev. Lex King Souter addressing members and guests at Semi-Annual Banquet at New Ocean House, Swampscott

Maybe it was necessary to use the high pressures and high velocities shown in the figures presented in order to establish basic data. If so, a minimum of necessary tests should be run, and then tests should be carried on at velocities normally used in heating systems in order to prove or disprove the theories deduced from the tests already made.

All the tests so far reported are for velocities of almost 3 to 13 fps, with cold water varying from 37 to 60 F. Heating systems are operated with water in the vicinity of 175 to 200 F. There may or may not be a difference in the results with cold and hot water, but since the designing engineer is interested in hot water and not cold water, should not the tests, for the time being, be confined to the use of hot water?

The friction loss in the 1-in. pipe under test would approximate 600 milinches loss per foot for 3 ft velocity and 3000 milinches per foot for 10 ft velocity, both of which are far beyond the normal losses permissible in any but very special cases.

What we need is to know what can be done when losses are between 150 and 600 milinches, the commonly used minimum and maximum allowable losses for 1-in. pipe, representing velocities of 18 to 36 in. per sec, and if there is no detectable noise at these velocities, what will be the highest velocity permissible before noise becomes apparent.

Fig. 6 shows noise levels through orifices of various areas. The curves A/8, A/4 and A/2 would apply to orifices having diameters of approximately 0.375, 0.4725 and 0.6675 in., respectively.

If Table 4 (p. 529) of THE GUIDE 1954 is worth anything, a glance at it would show that such orifices, at the velocities reported, would be useless for normal design conditions; a 0.35 in. diameter orifice in 1-in. pipe having a pipe velocity of 1 fps would be 32,000 milinches; a 0.45 in. orifice at 2 fps would be 37,000 milinches, while a 0.65 in. orifice at 3 fps would be 10,000 in.

Using the same formula to carry the velocities beyond those published that Dr. Giesecke used in preparing the table in THE GUIDE, the 0.375 in. orifice at 3 fps velocity would have a loss of approximately 91,500 milinches, and the 0.4725 in. orifice at 5 fps velocity would be 82,000 milinches or 82 in. per foot.

Would it not be possible, for the present, to confine the experiments to the velocities and temperatures normally used and thereby be able to give the information, so badly needed, to the designing engineer that much sooner and possibly at considerably less expense?

Following the study of fixed orifices, it would seem that gate or globe valves should be studied in order to determine the greatest pressure drop permissible through them without creating undue noise, and after that, tests could be run on other methods or designs of orifices which would accomplish the desired results without noise.

As one who has done a reasonable amount of designing large hot water heating systems, I think I speak from experi-

Guests savor New England cooking at Banquet with part of head table in view

Reg. F. Taylor thanks Pres. L. N. Hunter after presentation of his Memory Book

ence, and am sorry it seemed necessary to be so critical of a paper, which, on the face of it, shows so much thought and effort. I feel it will be a long time before usable information is forthcoming unless the trend of the present tests is changed into the channels more commonly used.

H. A. LOCKHART, Morton Grove, Ill. (WRITTEN): Although there are an infinite number of tests that could be devised to establish the noise generating characteristics of fluid handling equipment, the more basic research of simple geometric shapes might be more fruitful than the investigation of specific prototypes of currently manufactured fittings. This does not mean that quantitative evaluation of pipe fittings now on the market is not needed, but rather that it should not be the first objective of Professor Rogers' research effort.

Before becoming involved with the complexities of valves, it might be better to evaluate sudden enlargements, sudden contractions, gradual enlargements, gradual contractions, and simple changes in direction.

These suggestions are not meant to be criticism of the excellent progress made so far, but rather as encouragement to go even further.

E. L. WEBER, Seattle, Wash. (WRITTEN): The entire paper, especially Fig. 6, is extremely interesting and educational. It shows clearly that objectionable noises are not due to the velocity of water through the pipes but are due mainly to the turbulence produced by orifices, fittings, valves, etc.

Fig. 10 indicates clearly that globe valves should never be used in water distribution systems. It is recommended that the noise produced by angle valves, in various stages of closure, should also be studied, because this type of valve is almost universally used as shut-offs for plumbing fixtures and for radiator connections where they occasionally produce undesirable noises when throttled.

The energy used in producing noise is added to the friction head to be overcome in the distribution system. Hence a solution of noise problems will simultaneously provide a solution to friction head problems. The two problems are associated.

Table 1, (p. 525) of THE GUIDE 1954, shows a noticeable coincidence between the friction head through tees of various bores and the findings shown in Fig. 6 of the paper. This office prefers the use of all-welded pipe networks for hot water and panel heating systems and indicates branch take-offs from the mains by an arc connection similar to the branch take-offs customarily used in ventilating systems to reduce friction and noise (see Fig. 15, p. 723, THE GUIDE 1954).

A study of various radii of pipe bends and of branch take-offs for obtaining minimum noise level and friction should be of great value to the industry and could stimulate the manufacture of properly designed weld bends and branch take-offs, which could well compete in price with the hit and miss type produced in the field.

Past Pres. L. E. Seeley "toastmastering" at the Semi-Annual Banquet

I am pleased to note that the tests are being conducted at velocities up to 13.5 fps, and feel that velocities up to 20 fps in distribution mains will not be unusual in the future in high velocity water heating systems.

Mr. Edwards inquired whether the authors had any conversion factors to indicate the noise level at a distance of 1 or 2 ft from the pipe. He felt it might be possible to deduct a certain number of decibels from the noise level observed in the pipe for the purpose of finding the noise at a distance from the pipe. He pointed out that in distribution of air from outlets it was possible to make an approximation of the resultant noise level if the distance, absorption of the room and the overall noise level of the unit were known.

John W. James asked the author whether any comment could be made on the effect of higher velocities such as those used in snow melting. He also referred to Mr. Kern's remarks, and indicated that the TAC on Hot Water and Steam Heating was very much concerned about making practical application of the test information as soon as possible.

Edward Teske, Chicago, Ill., referred to Mr. Kern's comments, and stated that it would be necessary to consider high velocities because noises were caused by chilled water systems and circulating water systems for cooling towers as well as high velocity, high temperature water systems. He suggested also that tests should be conducted on the effects produced by the vibration of the pipes.

A. T. Jones, Toronto, Ont., Canada, suggested that it would be necessary to find the turbulence or vibration set up by the microphone and by the flattened portion of the pipe.

W. M. Wallace, II, Durham, N. C., inquired whether the noise transmitted from a pump could be reduced by inserting a section of rubber tubing in the flow pipe.

AUTHOR'S CLOSURE: Professor Rogers referred first to Mr. Edwards' comment, and stated that attempts were made in the early experiments to measure the sound level outside of the pipe, using an air microphone. Difficulty was found due to the ambient sound levels in the room which were usually great enough so that the smaller noises from the pipe could not be measured. It seemed probable that measurement of the vibration of the pipe wall will obtain better results than a measurement of the noise in the air.

Professor Rogers did not believe that a statement should be made at the present time regarding the attenuation of sound due to the pipe wall. He reported that the U. S. Navy had conducted a number of tests in an attempt to correlate the sound level inside of the pipe with the vibration of the pipe wall. In these tests, measurements had been taken at 1-in. intervals on the pipe for a length of 36 ft. In the experiments being conducted by Professor Rogers, the objective is to determine the cause of noise within the pipe. The transmission of this noise to the surrounding air may be another step in the investigation.

Referring to Mr. Wallace's question, the author stated that use of rubber tubing had been found necessary from the beginning of the experiments. The type of rubber hose had some effect on the amount of sound transmitted, and it was found that the reduction in sound transmission by the hose was not the same for all frequencies.

Professor Rogers stated that two or three experimental sound attenuators are being investigated, one of these being a tube filled with glass capillary tubes.

Referring to Mr. Jones' comment, the author stated that the location of the microphone did not seem to be too important. In a few cases, however, there was some effect due to its position. The slight amount of flattening of the pipe had only a negligible effect. Professor Rogers agreed that it was of first importance to investigate simple shapes rather than special fittings and valves. In reply to Mr. Kern, it was stated that tests had been run with water temperatures up to 160 F. Further tests will be made, but at present the possible maximum temperature is limited by the construction of the microphone.

Chairman Tuve announced that the fourth technical paper, Computation Charts and Theory for Rectangular and Circular Jets, by H. G. Elrod, Jr., (published in ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1954) would be presented by title. He pointed out that discussions of the paper could be sent to Society headquarters and would be considered for publication

with the paper in the 1954 TRANSACTIONS.

Chairman Tuve turned the meeting over to First Vice President Haines who adjourned the meeting at 12:30 p.m. (*Proceedings to be concluded in the September* JOURNAL SECTION.)

The pictures shown throughout these pages on the Proceedings at Swampscott are published through the courtesy of W. M. Wallace, II, Durham, N. C.

The "Lighter Side" at Swampscott

Sunday morning dawned clear and pleasant and 129 early arrivals boarded buses for Rowe's Wharf, Boston and thence to Provincetown via steamer across Massachusetts Bay. Despite the efforts of the many mechanical engineers aboard, the ship was forced to operate with only one propeller. However, a tired but happy group returned to the hotel at 10:00 p.m. and was served an excellent buffet supper.

Full-scale activities got underway on Monday noon as over 400 people filled the dining room to hear a word of welcome from A. L. Hare, vice chairman of the Committee on Arrangements. Edward Rowe Snow, prominent author and historian, was the Welcome Luncheon speaker and presented an interesting, illustrated talk on New England.

The Golf Tournament, in which 40 golfers participated, was held at the challenging Tedesco Country Club and attracted golfers, duffers, and others. Merrill F. Blankin retired the Research Cup with a low net score of 67. The Eichberg Memorial Trophy went to the Massachusetts Chapter represented by the team of W. G. Martin, Jr., J. MacG. Means and G. D. Maves with a three-man low net of 224. The Paul Bunyan Cup was awarded to H. S. Wheller, Sr., who had the high gross.

The Boston *Pops* Concert on Monday night attracted music lovers who heard Arthur Fiedler conduct an excellent program ranging from Dvorak and Liszt to such selections as *The Typewriter* and *TViana.*

Arthur Gregorian, noted authority on oriental rugs, entertained the ladies on this subject with his talk, *Oriental Rugs and the Stories They Tell,* on Tuesday morning. In the afternoon two busloads of sight-seers went to Boston to see some of its many historic sites and buildings. Another group boarded buses which took them to historic Salem and the famous old fishing port of Gloucester.

The savory delights of a New England shore dinner were enjoyed in the New Ocean House dining room on Tuesday evening. Gilbert E. Merrill of the Boston Museum of Science presented a talk called *Woodland Fears* which was one of the highlights of the meeting. Assisted by an assortment of turtles, owls, snakes and other reptiles, he had his audience alternately applauding and gasping. The children, in particular, sitting in the front row, were both entertained and educated by Mr. Merrill and his *supporting cast.*

Under threatening skies on Wednesday morning, a group of intrepid ladies toured a number of noted private North Shore Gardens and were rewarded with displays of breathtaking beauty.

The toastmaster at the Semi-Annual Banquet was the very capable Past Pres. Lauren E. Seeley, Durham, N. H., who introduced Pres. L. N. Hunter and other head table guests. President Hunter presented the Past President's Memory Book to Reg. F. Taylor. Rev. Lex King Souter, of the First Congregational Church, Fall River, Mass., gave the Banquet address, *Your Future is Now* in which he reminded his listeners of the importance of today's actions on tomorrow's results. Before the dancing started, R. T. Kern presented the three golf trophies, the Research Cup, the Eichberg Memorial Cup and the Paul Bunyan Cup. Dancing in the ballroom followed the Banquet.

Final registration figures showed that 287 members, 186 ladies, 56 guests and 39 children had attended and enjoyed their visit to Swampscott and the splendid efforts of the members of the Massachusetts Chapter as hosts.

ASHVE 1954 Semi-Annual Golf Tournament

Player	Net Score	Player	Net Score	Player	Net Score
J. E. Schechter	78	R. H. Kremer	72	H. L. Sanford	91
J. B. Hewett	80	B. L. Evans	83	R. H. Oberschulte	No card
K. J. Wagoner	81	H. I. Schmidt	79	Louis Burbo	No card
E. F. Glanz	70	E. J. Hoagland	76	W. J. Osborn	86
L. A. Steadman	67	L. B. Bedford	82	N. R. Gay	87
W. A. Williams	96	F. A. Merrill	87	H. S. Wheller	99
Jack Walter	80	W. P. Hollonbeck	108	H. S. Wheller, Jr.	93
W. G. Martin, Jr.	72	G. D. Maves	78	S. K. Smith	70
D. W. Noble	82	N. R. Trout	83	J. E. Reed	83
J. MacG. Means	74	C. R. Acheson	83	N. D. Skinner	82
J. W. Cooper	81	J. W. May	78	M. F. Blankin	67
G. W. F. Myers	79	H. J. Noles	83	M. F. Rather	75
W. O. Stewart	83				

DELTA AND ILLINOIS CHAPTERS HONOR PAST PRESIDENTS

Delta Chapter's First President Introduces His Successors

The first president of the Delta Chapter, G. E. May, introduced the past presidents attending the April meeting, including W. P. Oster, Ralph Elizardi, Theodore Offner, J. S. Burke, Walter Cooke and L. V. Busenlener. Mr. May requested that the flowers on the past presidents' table be sent to the widow of L. V. Cressy, charter member and fourth president of the Chapter, who died on April 4. J. E. Leininger, associate of Mr. Cressy at the time of his death, read his drafted resolution to the members to serve as Delta Chapter's memento for Mrs. Cressy.

W. B. Martin, Jr. introduced the speaker, B. H. Schulze, vice president and eastern sales manager, Kewanee Boiler Corp., New York, whose topic was the *Proper Selection and Application of Boilers and Boiler Controls.*

A belated past president's certificate was presented to Walter Cooke, and O. F. Schully, membership chairman, introduced the new members present. Pres. H. L. Salaun presided. Attendance 59.

Past Presidents of Delta Chapter (*L. to R. seated*) Theodore Offner, H. L. Salaun, G. E. May, Ralph Elizardi. (*Standing*) L. V. Busenlener, Walter Cooke, J. S. Burke, W. P. Oster

Society's Oldest Chapter also Host to President Hunter

The Merchandise Mart in Chicago was the scene of the May meeting of the Illinois Chapter where members, including over 20 past presidents, and guests enjoyed dinner at the Merchants and Manufacturers Club.

H. H. Van Epps introduced Pres. L. N. Hunter, Johnstown, Pa., who spoke to the Chapter on the goals and objectives of the Society. President Hunter said that all members should understand the purposes of the Society, and that activities should be examined to see if they are educational and serve the advancement of the arts and sciences of heating, ventilating and air conditioning for the general public. He further noted the many accomplishments of the Society and pointed out areas where there still is much to be done.

L. N. Hunter
Johnstown, Pa.

Chairman of the board of tellers, C. W. Johnson, announced the newly elected officers: *President*—G. V. Zintel; *Vice President*—G. G. Freyder; *Secretary*—H. G. Gragg; *Treasurer*—J. F. Cummiskey; *Board of Governors*—H. E. Anderson, E. P. Heckel, Jr. and H. C. Stevens. Attendance 127.

• *ARKANSAS*: Following a social hour at the Sam Peck Hotel, Pres. R. E. Blaylock called the May meeting to order.

Herman Cumnock introduced the speaker, R. L. Sherrill, Jr., Westinghouse Corp., Dallas, Tex., who spoke on *Packaged Heat Pumps*, giving an interesting report on actual operating cost for residential installations. Attendance 34. Attendance ratio 0.40.

• *ATLANTA*: At the May meeting, Pres. J. G. Croley announced the election results and introduced the following officers for the coming year: *President*—J. M. Lazenby; *Vice President*—T. A. Barrow, Jr.; *Secretary*—F. W. Bull; *Treasurer*—J. A. Marshall; *Board of Governors*—J. G. Croley and W. J. McKinney.

Summary of Chapter Meetings*

(Continued)

President Croley expressed his thanks to the membership for their support and particularly praised J. A. Marshall, program chairman, and W. M. Garrard, chairman of the social committee. Attendance 184.

• *BALTIMORE*: Fritz Honerkamp, Anemostat Corp. of America, Hartford, Conn., believes that high velocity air distribution, while new, is very sound engineering. Speaking at the May meeting on the *Fundamentals of High Velocity Air Distribution*, Mr. Honerkamp noted the advantages and disadvantages of this method. He suggested that best results could be obtained by following the standard duct design. F. M. Hewitt introduced the speaker, and Pres. H. D. Glaser thanked Mr. Honerkamp for his fine presentation.

A unanimous ballot was cast for the following: *President*—E. H. Taze; *Vice President*—E. J. Morris; *Treasurer*—W. W. Hill; *Secretary*—R. F. Weisman; *Board of Directors*—G. M. Baldwin, A. J. Simpson and H. D. Glaser. Mr. Taze, as new president, congratulated President Glaser for the successful fulfillment of his term as president, and the past president's pin was presented amid loud applause from the membership. Attendance 28. Attendance ratio 0.25.

• *CENTRAL NEW YORK*: At the April meeting unanimous election of officers resulted in the following: *President*—F. D. Putnam; *Vice President*—L. A. Childs; *Treasurer*—H. J. Morton; *Secretary*—Merle Weninger; *Board of Governors*—H. K. Ormsby, Jr., and K. T. Sprague. Pres. C. R. Acheson appointed D. M. Mosteller and R. R. Morse as tellers.

Vice President F. D. Putnam introduced P. A. Argentieri, engineering administrator, W. B. Connor Engineering Corp., Danbury, Conn., who gave a commentary on the economics of high velocity air distribution. Attendance 47. Attendance ratio 0.37.

• *CINCINNATI*: Newly elected officers at the May meeting were as follows: *President*—F. W. Wilson; *Vice President*—A. H. Gerdsen; *Secretary*—R. G. Anderson; *Treasurer*—T. D. Reiley; *Board of Governors*—C. P. Krantz. Serving as the election committee were R. F. Taggart, R. A. Albrecht, Jr., and N. A. Frankel. Pres. R. C. Beineke thanked the committee chairmen and the members for their excellent cooperation, and was presented the past president's pin by incoming President Wilson.

The golf tournament awards were distributed by E. A. Sobolewski, and H. E. Russell was named as delegate to the Chapters Conference Committee for the Semi-Annual Meeting at Swampscott. Attendance 83. Attendance ratio 0.47.

• *EMPIRE STATE CAPITAL*: Chairman of the by-laws committee, R. B. Taylor, reported to the members at the June meeting. Other chairmen appointed by Pres. E. C. Doyle were: *Finance*—E. J. Mahoney; *Publicity*—R. D. Marshall; *Membership*—R. F. Peck; *Attendance*—M. E. Waddell; and *Program*—H. S. Bond.

Following a general discussion of the program, the chairman promised to arrange a program in printed form for presentation to the members at the next meeting. Attendance 16. Attendance ratio 0.32.

• *GOLDEN GATE*: A vote of appreciation was given at the June meeting to Pres. J. E. Murray and L. E. Shea. President Murray was presented with his past president's pin by T. J. White. After thanking the officers for their cooperation, President Murray tendered the gavel to incoming Pres. Eric Roberts. Other officers elected were: *Vice President*—D. E. McLeod; *Secretary*—F. K. Crouch; *Treasurer*—Herb Duncan; *Board of Governors*—J. B. Smith and James McLachlan. K. F. Baldwin, Jr. acted as chairman of the tellers committee.

Herb Duncan and Paul Stoker jointly offered an interesting program on *Application of a Metering Type Combustion Control*. Attendance 55. Attendance ratio 0.22.

• *INLAND EMPIRE*: ASHVE Pres. L. N. Hunter, Johnstown, Pa., was guest speaker for the April meeting. He explained the aims and purposes of the Society and gave an address on the *Rating of Heating Boilers*. President Hunter reviewed the reasons for the *I-B-R*, *SBI*, and *AGA* rating codes and the methods of determining such ratings.

Elections were held with the following unanimous results: *President*—H. A. Bickel; *Vice President*—F. W. Jenkinson; *Secretary*—Max Tonn; *Treasurer*—J. A. Doyle; *Board of Governors*—K. M. Wood and D. E. Arnold. Attendance 33.

• *IOWA*: Introduction of guests was the first order of business after

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

Pres. J. F. Sandfort called the meeting to order. R. H. Schnell presented the nominating committee's nominations for officers for the 1954-55 season.

T. W. Thorpe, president of the Thorpe Well Co., Des Moines, Ia., was the speaker at the April meeting. Mr. Thorpe gave a very interesting talk on the conditions affecting the level and chemical analysis of ground waters in various areas. His talk was supplemented with slides which showed accepted types of deep well construction and geological strata. He particularly stressed the importance of conservation of ground waters if a sufficient supply is to be maintained for use as a heating and cooling medium in air conditioning and heat pump systems. Attendance 33.

• *MANITOBA*: J. C. Stangl presided at the May meeting held at the Pine Ridge Golf & Country Club. Golf awards were distributed by G. T. Christie. Newly elected officers were announced as follows: *President*—D. B. Brace; *Vice President*—G. C. Davis; *Secretary* and *Treasurer*—G. T. Christie; *Board of Governors*—A. K. Piercy, J. A. Bell, A. J. McIntyre, H. F. Randall, J. C. Stangl, R. G. Cawker, D. B. Decker, and R. M. Fraser.

A vote of thanks was given to the outgoing officers for their work and to the committee on arrangements: J. C. Stangl, G. T. Christie and D. S. Swain. The meeting was adjourned to allow dancing for the evening. Attendance 35.

• *MISSISSIPPI*: *Large Volume Water Heating* was the subject of the talk by O. M. Olsen, vice president and general manager, Sellers Engineering Co., Chicago, at the May meeting. M. E. Arledge introduced the guest speaker.

Treas. T. E. Stepan gave a financial report, and plans for a summer picnic were discussed. Attendance 27.

• *NEBRASKA*: Officers for the 1954-55 term were elected as follows: *President*—C. A. Goth; *Vice President*—T. W. Davis; *Secretary*—L. J. Paulsen; and *Treasurer*—F. E. Hawley.

Also at the May meeting, R. E. Braumiller, Chicago branch of Babcock & Wilcox, showed an interesting colored sound movie on the history, application and progress of *Steam for Power*, concluding with a question and answer period. Attendance 40.

• *NEW YORK*: Vice Pres. R. L. Stinard called the meeting to order and annual reports were given by C. H. Flink, secretary, and W. M. Heebner, treasurer. The minutes of the previous meeting were read and approved.

New officers for 1954-55 were elected as follows: *President* — R. L. Stinard; *Vice President* — Albert Giannini; *Secretary* — Carl H. Flink; *Treasurer* — W. M. Heebner; *Board of Governors* — H. S. Birkett, J. B. Hewett, C. R. Hiers, W. O. Huebner and J. E. Schechter.

Vice President Stinard introduced the speaker, C. M. Wilson, general sales manager, Anemostat Corporation of America, New York, N. Y., who spoke on *Fundamentals of High Velocity Air Distribution and Diffusion*. He discussed the problems arising in the design of high velocity air distribution systems, and illustrated the principles of operation by means of slides. The advantages of high velocity systems were outlined. Attendance 160. Attendance ratio 0.31.

• *NORTH JERSEY*: Annual reports by the officers were read at the May meeting, and Pres. A. A. Bearman concluded with the reports on attendance, publicity and membership. The new officers were installed by President Bearman, who presented the gavel to incoming Pres. H. M. Patrick.

J. H. Carpenter, Carrier Corp., Syracuse, N. Y., talked about the use of psychrometric charts, illustrating with samples. Attendance 61. Attendance ratio 0.38.

• *NORTH TEXAS*: Howard Carraway, author of pamphlets on salesmanship and conductor of sales clinics, was introduced to the members at the May meeting by A. W. Stubbeman. Mr. Carraway discussed the many opportunities that exist in sales today.

Pres. M. W. Brown announced the appointment of R. E. Allison, chairman, J. P. Ashcraft, J. R. Dowdell, W. A. Catlett and A. W. Stubbeman as a committee to raise funds for the Giesecke Memorial. Mr. Stubbeman and C. L. Zahn were praised for a well-planned meeting. Attendance 122. Attendance ratio 0.52.

• *NORTHEASTERN OKLAHOMA*: William Wendt, Dallas, Tex., Dist. Mgr., Ready Power Co., was the speaker at the May meeting. He discussed the adaptation of gas engine drive to a radial compressor for air conditioning duty.

Discussion of summer plans resulted in the decision not to hold further meetings until September, and considerable interest was shown by members who wished to join the Annual Stag Party to be given by the Oklahoma Chapter. The best possible method of expenditure of the bank balance was referred to the Board of Governors. Attendance 29. Attendance ratio 0.46.

• *NORTHERN PIEDMONT*: G. H. Ficken, program chairman, introduced John Engalitcheff, Jr., president, Baltimore Aircoil Co., Inc., Baltimore, Md., who spoke on *Evaporative Condensers — Their Selection and Application*. An open forum was conducted after the talk. Mimeo-

graphed copies of the Chapter by-laws were presented to the members. Attendance 27. Attendance ratio 0.32.

• *OKLAHOMA*: *The Control of Building Heating from Outdoors* was the subject of a talk by H. T. Kucera, president, Automatic Devices Co., Inc., Western Springs, Ill., who was introduced at the May meeting by Louis Loeffler, Jr. Noting the early history of outdoor controls, Mr. Kucera brought his audience up to date on present-day methods, discussing both intermittent and continuous flow types and special conditions to be considered in the selection of proper outdoor controls.

Pres. F. X. Loeffler, Jr. announced the following election results: *President*—G. E. Ervin; *Vice President*—J. R. Patten: *Secretary*—F. R. Denham; *Treasurer*—A. C. Shelley; and *Board of Governors*—F. X. Loeffler, Jr., J. H. Carnahan and W. J. Collins, Jr. Attendance 51. Attendance ratio 0.49.

• *ONTARIO*: Pres. N. W. Kingsland welcomed M. E. Minaker, past president of British Columbia Chapter, who was present at the annual meeting held in May. F. D. Ledgett announced that 26 new members had been enrolled this past year, and an increase in the University of Toronto student award was approved.

Newly elected officers are: *President*—M. C. Bailey; *Vice President*—D. L. Angus; *Secretary-Treasurer*—H. R. Roth; *Board of Governors*—C. J. Bootes, Charles Torry, John Thompson and N. W. Kingsland. President Bailey gave Mr. Kingsland a past president's emblem and a framed certificate of appreciation signed by the Board of Governors. The presentation of an educational film on corrosion received favorable comment. Attendance 82.

• *OTTAWA VALLEY*: Pres. G. L. Ostiguy introduced F. G. Phipps, Montreal, who gave a brief resume of the development of *Pneumatic Ash Conveying Systems* at the May meeting. In his entertaining and informative talk, Mr. Phipps touched on the various types of systems, including pneumatic and sluicing, and showed films to illustrate.

Officers elected were: *President*—W. J. Robinson; *Vice President*—E. J. Schoenherr; *Secretary*—N. J. Howes; *Treasurer*—D. W. Banton; *Board of Governors*—G. L. Ostiguy, J. D. Partington, L. J. Greenough and S. J. Bullis. President Robinson thanked outgoing President Ostiguy for his untiring efforts and expressed the hope that the new year would be as instructive as the past. Attendance 32. Attendance ratio 0.47.

• *PACIFIC NORTHWEST*: The problems of smog, other phases of air pollution and suggested techniques for control were discussed by R. G. Fleagle, associate professor of meteorology, University of Washington, at the May meeting. Following his talk, entitled *Weather and Air Pollution in the Northwest*, there was a lively question and answer period.

L. F. Christofferson, secretary, announced that the revised Chapter by-laws were ready for submission for approval. The balloting committee reported the election results: *President*—T. C. Caskey; *First Vice President*—I. L. Winsor; *Second Vice President*—L. F. Christofferson; *Secretary*—E. W. Triol; *Treasurer*—M. W. McKinstry; *Board of Governors*—J. A. MacDonald and C. L. Timpe. Attendance 55. Attendance ratio 0.42.

• *PHILADELPHIA*: Election of officers at the April meeting produced the following slate: *President* — L. M. Church; *First Vice President* — A. M. Robertson; *Second Vice President* — C. J. Lubking; *Treasurer* — P. H. Yeomans; *Secretary* — C. J. Forve; and *Board of Governors* — R. J. Sigel.

After the nominating committee report by C. F. Dietz, A. M. Robertson called upon Colonel Tisdale of the Philadelphia Ordnance Division to introduce the speaker. An interesting talk on *Guided Missiles* was given by Gen. T. K. Vincent of Redstone Arsenal, Birmingham, Ala. Attendance 110. Attendance ratio 0.11.

• *SACRAMENTO VALLEY*: The feature talk of the May meeting was given by D. D. Wile, Refrigeration Engineering, Inc., Los Angeles, on *Planning Air Conditioning Systems to Avoid Clamminess on Muggy Days*. Mr. Wile rated the effectiveness of various methods.

J. E. Marshall appointed R. A. Sarro, D. R. Peterson and R. B. Walker as the auditing committee. Attendance 52. Attendance ratio 0.46.

• *SHREVEPORT*: Unanimous election results were as follows: *President*—J. S. Malahy, Jr.; *Vice President*—R. S. Segall; *Secretary*—H. E. Scott; *Treasurer*—A. L. Jones, Jr.; *Board of Governors*—Osborne Dykes, Jr., L. E. Kneipp and M. A. Hudson. R. F. FitzGerald, chairman of the special events committee, reported on the annual picnic.

E. J. Stearn, Armstrong Cork Co., Dallas, presented slides on current research. Attendance 34. Attendance ratio 0.57.

• *SOUTHERN PIEDMONT*: In the absence of the guest speaker for the May meeting, Pres. R. S. Fullerton presented a slide with recorded commentary on the *Manufacturing of a Centrifugal Refrigeration Machine*. D. L. Howard, program chairman, offered the membership a choice of future speakers and subjects.

President Fullerton presented the past president's pin to R. E. Mason, and Secy. J. R. Clark gave the report of the joint meeting to be held at Roaring Gap. Attendance 31. Attendance ratio 0.25.

• *SOUTHERN CALIFORNIA*: A general description of *The Operation and Cost of Operating the Largest Heat Pump in the Country* was given by J. D. Kroeker, Portland, Ore., stimulating considerable discussion at the June meeting. Mr. Kroeker explained that it is not truly a heat pump at the Equitable Building in Portland, but rather a system of total economy, salvaging every possible vestige of heat which may be produced in the building.

Pres. L. B. Davenport presented the new officers: *President*—C. D. Walz; *Vice President*—J. L. McCullough; *Secretary*—H. F. Ulovec; *Treasurer*—W. J. Biggar; *Board of Governors*—K. A. Bowman, Robson English, A. Z. Levine and J. R. Hall. President Davenport expressed appreciation for the work of the various committees. Attendance 77.

• *WEST TEXAS*: A panel of three guest speakers, engineers of the Southwestern Public Service Co., Lubbock, talked at the May meeting on electrical distribution, the metering of electrical power and the utilization of electrical energy. A lively question and answer period followed this presentation by Fray Smith, Jack Barber and Rex Brown.

Approval was given for a social meeting in June, and Program Chairman M. J. Aderton appointed R. A. Mixon as vice chairman of the social party committee to be assisted by William Root and W. R. Anthony. Attendance 25. Attendance ratio 0.31.

• *WESTERN NEW YORK*: The life of THE GUIDE from its first edition in 1922 to the 1954 copy was outlined by R. E. Cherne, partner, Crocker, Cherne & Dickenson, Rochester. Mr. Cherne, who is chairman of The Guide Committee, told of the many problems encountered in publishing an edition and took notes on suggestions from the membership.

John R. Allen Memorial Library

The ASHVE Committee on Research gratefully acknowledges the following gifts to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

Proceedings of the National District Heating Association, Vol. XLII, 1951. Pittsburgh, Pa. Gift of the *National District Heating Association*, 1954.

H. M. Nobis, Society Life Member, recently donated the following books and instruments:

Mathematics for Engineers, by Dull.
Heat Engineering, by Bailey.
ASHVE GUIDE (19 volumes, dating back as far as 1922).
ASHVE TRANSACTIONS, (1916 to 1921 inclusive, and 1930 to 1951 inclusive).
Harmful Gases and the *Effects of Clothing and Environment on Health* (two German texts).
One revolving vane type anemometer.
One incline manometer.
One velometer, complete with jets.
One gas analyzer (Orsat).
One recording thermometer with 12 inch chart.
Miscellaneous thermometers.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

Balloting results were announced by Pres. C. W. Stone: *President*—Q. P. Thompson; *First Vice President*—C. W. Kaupp; *Second Vice President*—V. N. Harwood; *Secretary*—G. E. Kuhn; *Treasurer*—M. C. Beman; *Board of Governors*—C. W. Stone, M. C. Beman, Roswell Farnham, D. J. Mahoney and J. M. Quackenbush. A Life Membership certificate was presented in absentia to E. F. Wendt. Q. P. Thompson paid tribute to President Stone's accomplishments of the past year. Attendance 34. Attendance ratio 0.26.

• *WESTERN NEW YORK*: A joint meeting of the Western New York Chapter members with a group of Society members living in the Rochester area included a trip through the Delco Company plants A and B in Rochester. Members were welcomed by E. Wallage.

Pres. C. W. Stone, who presided over the April meeting, introduced Program Chairman Q. P. Thompson, who gave a brief summary of forthcoming events. Attendance 76.

• *WISCONSIN*: Pres. L. N. Hunter, Johnstown, Pa., was guest speaker at the May meeting of the Wisconsin Chapter. Speaking on *The Rating of Heating Boilers*, President Hunter discussed the codes and various factors in selection.

A Life Membership certificate was presented by President Hunter to J. S. Jung. Mr. Jung expressed his appreciation for the membership certificate. F. W. Goldsmith reported that the publicity committee had selected H. L. Painter to receive the Gustus L. Larson Award.

The tellers reported the following elected: *President*—L. C. Plaehn; *Vice President*—I. J. Rossiter; *Treasurer*—H. K. Forfar; *Secretary*—H. W. Alyea; *Board of Governors*—A. A. Stutheit and H. F. Brinen.

Following the presentation of the past president's pin to N. E. Hill, he presented an engraved gavel to Mr. Plaehn, the incoming president, who promised to encourage attendance at meetings. Attendance 79. Attendance ratio 0.34.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 69 applications for membership, including 1 reinstatement; in addition 7 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by August 31, 1954, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement

California

ALTON, W. V., Contractor, Marysville. REFERENCES: R. T. Andrews, E. C. Sanford, C. B. Smith, R. E. Williams.

REZNICK, D. E., Pres., Airfan Engrg. Co., Los Angeles. REFERENCES: L. B. Davenport, M. C. Greiner, J. R. Hall, A. J. Hess.

WEST, ALBERT, Partner, Colan Heating & Sheet Metal Co., San Francisco. REFERENCES: J. F. Deane, J. E. Hedquist, R. R. Taylor, G. J. Yamas.

WINSKILL, R. W., Factory Field Repr., Ray Oil Burner Co., San Francisco. REFERENCES: E. E. Foote, J. B. Notkin, R. B. Plass, J. I. Sprott.

WYSOCKI, JERZY, Design Draftsman, Welton Becket & Assoc., Los Angeles. REFERENCES: R. C. Johannesen, B. M. Lemos, F. M. Neal, M. H. Tanabe.

Colorado

PERKIS, J. F., Chief Engr., Fox Metal Products Corp., Littleton. REFERENCES: M. L. Cuenin, H. M. Frickey*, E. L. Heckman, E. P. Murr.

Connecticut

BEARSE, A. H., JR., Mgr., Chappell Fuel & Lumber Co., New London. REFERENCES: James Axeman, G. B. Gerrish, J. M. Kipe, R. A. Protheroe.

DONOVAN, W. J., Dir. of Engineering, Bush Manufacturing Co., W. Hartford. REFERENCES: Thomas Arnold, Cecil Boling*, Fritz Honerkamp, Joseph Pierce.

HOLLENBECK, W. P., Research & Dvlpt. Engr., The G. & O. Manufacturing Co., New Haven. REFERENCES: M. L. Carangelo, O. D. Colvin, E. R. Queer, G. W. Sprague.

JENNINGS, L. E., JR., Appl. Engr., Sturtevant Div., Westinghouse Electric Corp., Hartford. REFERENCES: C. T. Eskola, R. C. Murphy, E. V. Olsson, C. P. Perrin.

District of Columbia

FAHRINGER, V. T., Mgr., Htg. and Air Conditioning Dept., John G. Webster & Sons, Washington. REFERENCES: J. J. Chaconas, Sr., C. B. Harrison*, G. C. Webster, J. G. Werner.

△HOLLIDAY, C. W., Sales Mgr., F. C. Clifford, Inc., Washington. REFERENCES: R. S. Allen, I. H. Dale, W. C. Jones, W. H. Singleton.

MILLER, R. R., Heating & Air Conditioning Engr., John G. Webster & Sons, Washington. REFERENCES: J. J. Chaconas, Sr., Joseph Dean*, G. C. Webster, Richard Werner*.

REPAK, P. N., Htg. & Air Conditioning Engr., John G. Webster & Sons, Washington. REFERENCES: J. J. Chaconas, Sr., A. B. Devore, G. C. Webster, J. G. Werner.

STREB, S. S., Htg. & Air Conditioning Engr., John G. Webster & Sons, Washington. REFERENCES: J. J. Chaconas, Sr., A. B. Devore, S. S. Streb, Sr*., G. C. Webster.

Florida

DESMON, L. G., Pres., Air Engineering, Inc., Sarasota. REFERENCES: James Dailey, Edward Garfield, S. F. Graziano, Seymour Lieblein*.

Georgia

BRASINGTON, G. W., Engr., Carrier Atlanta Corp., Atlanta. REFERENCES: A. L. M. Amphlett, L. L. Barnes, J. G. Croley, C. F. Daugherty.

Indiana

△VOGEL, G. W., Partner, Pfau-Vogel Co., Indianapolis. REFERENCES: R. C. Blackman, R. I. Drum, E. G. Fowler, C. F. A. Locke.

Louisiana

ANGLE, H. G., Sales Engr., Minneapolis-Honeywell Regulator Co., Shreveport. REFERENCES: F. C. Brandt, B. L. Byrd, D. L. Lottinger, R. L. Patton.

FRANK, F. M., Estimator, Johns-Manville Sales Corp., New Orleans. REFERENCES: Fred Dupre*, C. B. Gamble, G. C. Kerr, G. E. May.

GLORE, H. G., Sales Mgr., Gulf York Inc., New Orleans. REFERENCES: R. B. Barrett, W. A. Houghton, O. F. Schully, E. J. Shepherd.

MITCHELL, J. C., Mgr., Coleman Div., Walther Bros. Co., Inc., New Orleans. REFERENCES: C. W. Mackie*, C. C. Walther, Fred Weathersby*, Jack Whittaker*.

STRAUCH, W. G., Repr., Gulf York Inc., New Orleans. REFERENCES: J. E. Reed, I. M. Richardson, Robert Schultz, A. W. Shelby.

WOODWARD, C. B., JR., Distr. Field Engr., General Electric Co., New Orleans. REFERENCES: J. S. Adair, C. B. Gamble, J. E. Leininger, M. P. Veith.

Massachusetts

BARA, S. A., Owner, Steven's Distributors. Heating & Air Cond. Engrs., South Hadley Falls. REFERENCES: George Hartwell*, Clement Paneta*, Edward Petraitis*, Henri Soumerai.

HOLLETT, W. R., Sales Engr., Johnson Service Co., Boston. REFERENCES: J. H. Colby, W. G. Martin, Jr., D. C. Miller, E. M. Tracey.

LANG, F. N., Sales Engr., Dravo Corp., Boston. REFERENCES: W. L. Davidson*, G. D. Fife, C. W. Stewart, G. B. Torrens.

WHITE, H. F., Br. Mgr., The National Radiator Co., Boston. REFERENCES: C. M. Baumgardner, L. N. Hunter, J. A. Ivester, E. N. McDonnell.

Michigan

BROWN, W. A., JR., Estimator-Engr., R. L. Spitzley Heating Co., Detroit. REFERENCES: G. W. Akers, R. H. Oberschulte, J. H. Spitzley, R. L. Spitzley.

DAVIS, C. S., JR., Pres. & Gen. Mgr., Hydraline Products Div., Borg-Warner, Detroit. REFERENCES: H. E. Blood*, Eugene Farrell*, Warren Harris, L. G. Miller.

△MANGRUM, R. W., Mgr. Suburban Dept., American Blower Corp., Detroit. REFERENCES: J. T. Anderson, C. H. Pesterfield, F. C. Warren, H. W. Wolters.

Minnesota

NYGREN, D. L., Repr., William Bros. Boiler & Mfg. Co., Minneapolis. REFERENCES: R. G. Gridley, E. A. Johnson, M. L. Oftedal*, G. M. Orr.

SPARROW, H. T., Dir., General Engrg. Dept., Minneapolis-Honeywell Regulator

Co., Minneapolis. REFERENCES: J. E. Haines, J. S. Locke, E. F. Snyder, Jr., J. M. Wilson.

△STURM, WILLIAM, Chief Mech. Engr., Ellerbe and Co., St. Paul. REFERENCES: A. B. Algren, J. E. Haines, O. L. Lilja, J. S. Locke.

Missouri

△HUNDELT, L. W., Owner, Consolidated Engineering & Sheet Metal Co., St. Louis. REFERENCES: W. A. Bemis, B. L. Evans, W. F. Myers, H. C. Sharp.

New Jersey

LEWIN, MAX, Owner, Max Lewin Heating, Trenton. REFERENCES: Harry Jaeger*, William MacArthur*, Joseph Scullin*, Ralph Stout*.

New York

BARGER, R. B., Regional Mgr., General Controls Co., Long Island City. REFERENCES: A. B. Hamilton*, A. W. Johnston, Jr.*, W. O. Mosher*, C. G. Segeler*.

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C. F. ROTH OF INTERNATIONAL EXPOSITION DIES

Charles F. Roth, president of the International Exposition Co., New York, N. Y., died on June 24, 1954, at Northern Westchester Hospital, Mount Kisco, as a result of injuries received in an automobile accident on May 3.

Born in New York City in 1886, Mr. Roth was educated in New York City public schools and received a B.S. degree in chemistry in 1912 from Cooper Union. His first job had been as control chemist of the National Brewers Academy (1907-10). In 1911 he became chemist and later chief chemist of the Standard Oil Co. of New York, and three years later was appointed chemist and manager of manufacturing of the Hartford Cast Stone Co., Hartford, Conn.

In 1912 he served as a member of the Eighth International Congress of Applied Chemistry. Mr. Roth began his work as an organizer of chemical exhibitions in 1915, and in 1922 he added to that work the task of managing national expositions in the engineering field.

During World War I he served as officer in charge of adjustment branch personnel, Chemical Warfare Service, U.S. Army, and as a member of the U.S. War Savings Stamp Committee. Throughout this period he also served as consulting chemist of the International Filtration Corp. and director of the Beckman & Linden Engineering Corp., San Francisco (1919-24) as well as consultant for the Livingstone Co., Baltimore (1917-27).

In 1923 he became secretary-treasurer of the International Exposition Co., becoming vice president in 1925, and in 1937 he was named president.

Following the war, Mr. Roth managed many expositions, among which were the National Exposition of Power and Mechanical Engineering, the Paper Industries Exposition, and several of the expositions in the engineering and air conditioning fields.

Besides managing the International Heating, Ventilating, and Air Conditioning Expositions, the first of which was held in 1930, Mr. Roth managed the National Electrical Exposition in 1929, the National Hotel Exposition 1934-36, the Chicago Ex-

position of Power and Mechanical Engineering since 1936, and the Pacific Heating and Air Conditioning Exposition, San Francisco 1940-41.

Mr. Roth joined the ASHVE in 1930 and was a familiar figure at its Annual and Semi-Annual Meetings. In addition to being a member of the Society, Mr. Roth had very close association with ASHVE activities and its members through his management of the Heating, Ventilating, and Air Conditioning Expositions.

He was a quiet man with strong convictions and had a deep understanding of his fellow man. Because of this understanding manner he won the profound respect of all who were privileged to work with him, as well as all those he came in contact with in the industrial field and in the engineering profession. He was a lifelong reader of technical and scientific literature and had an extensive library on many branches of engineering in which he had a keen interest. He had many diversified interests, especially in the sciences, arts and literature, and was a delightful companion because he was so well informed.

Mr. Roth was also a member of the *American Institute of Mining and Metallurgical Engineers, American Institute of the City of New York*, the *American Chemical Society*, and a member of the Chemists Club of New York. He won many awards for his work, including the Cooper Medal. He served on many of the medal award committees, among which were the Nichols Award Jury and the Perkin Medal Award Committee.

Mr. Roth is survived by his widow, Mrs. Carol Thrall Roth, a sister, Miss Anita Roth, and a grandson, Charles R. MacDonald, to whom the Officers and Council of the Society extend their deepest sympathy. His many friends attending the Semi-Annual Meeting in Swampscott were greatly shocked by the news of his untimely passing and expressed their heartfelt sympathy to his family and associates.

Services for Mr. Roth were held at his residence, Dreamthorp, Long Ridge Road, Bedford Village, N. Y., on Saturday, June 26, and interment was in Kensico Cemetery, Valhalla, N. Y.

DELBERT V. CASE
Atchison, Kans.

Delbert Vernon Case, manager of U. S. Natural Cooler, Atchison, Kans., died on May 11, 1954 at the age of 66. The Society was grieved to learn of the death of Mr. Case, who had been a member since 1937.

Mr. Case was born in Owatonna, Minn., on June 4, 1887. He was graduated from the Pillsbury Academy in 1905. After working as an architect in Duluth, he entered sales engineering in 1914, doing work in heating, ventilating, refrigerating and

air conditioning, spending several years in Kansas City. He was called to Atchison in 1944 as consulting engineer for the War Food Administration to assist in refrigeration work at Kerford Cave. He often participated in storage experiments, and stayed on as engineering manager there until his retirement in 1953.

He is survived by his wife, Ellen Case; his daughter, Mrs. Malcolm Miller of Prairie Village; his sons, D. P. Case of Phoenix, Ariz., J. S. Case of Louisville, Ky., D. V. Case, Jr., and W. R. Case, both of Cleveland, Ohio. The Officers and Council of the Society extend their heartfelt sympathy to the family.

H. ALLEN FROELICH
Junction City, Kans.

It is with regret that the Society announces the passing on May 18 of H. Allen Froelich, owner of the Froelich Heating and Air Conditioning Co. Mr. Froelich, who joined the Society in 1939 as an associate member and became a member in 1951, was born in Chicago on October 11, 1905. He graduated from Wentworth Military Academy, Lexington, Mo., and attended The Principia, St. Louis.

With a long background in designing, installing and servicing heating and cooling equipment, Mr. Froelich set up his own company in 1945 in Junction City, Kans., to handle installation of furnaces, burners and mechanical equipment.

The Officers and Council of the Society extend their deepest sympathy to his survivors.

L. VILLERE CRESSY
New Orleans, La.

The Society is sorry to announce that it has received word from the Delta Chapter of the death of L. Villere Cressy on April 4, 1954. Mr. Cressy joined ASHVE in 1940 and rapidly became an active member of Delta Chapter, serving as president, 1943-45. He was also a member of the *Louisiana Engineering Society*.

Born in New Orleans on May 7, 1900, Mr. Cressy received his B.A. from St. Aloysius College in 1919, and then studied mechanical engineering at Tulane University. For seven years, he designed and supervised heating, ventilating and plumbing installations for F. H. Chisholm, construction engineers. In 1928, he turned to sales engineering and became a representative for Hester-Bradley of St. Louis in the New Orleans territory, and from 1929-39, he represented several companies. Entering the consulting field in 1940, he began the partnership, L. Villere Cressy & Lewis S. Alcus.

The Officers and Council of the Society extend their deepest sympathy to his widow.

WILBUR C. KELLY
Portland, Ore.

It is with deep regret that the Society announces the death of Wilbur C. Kelly, aged 54, on May 8, 1954.

Mr. Kelly was born in Portland, Ore. on July 7, 1899. He attended Washington High School and received a B.S. degree from Oregon State College in 1923. He began as construction foreman with Western Lumber Co., Westfir, Ore. In 1925 he was employed by the Port of Portland Harbor Commission as an engineer on steamship dock construction, and later became engineer and bridge foreman for the Warren Construction Co. From July 1927 until the time of his death, Mr. Kelly was connected with the Iron Fireman Manufacturing Co., first in its offices in Toronto, Ont., Canada, as field engineer; in St. Louis, Mo., 1944-48, as division engineer; and finally in his hometown of Portland as branch engineer.

He was a member of the Society for the past 19 years. The Officers and Council extend their sincere sympathy to his sister, Miss Laura Kelly.

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Group A—Heat and Distribution Within and Behind the Panel: R. L. Maher, Chairman, H. L. Flodin, G. D. Lain, L. J. LaTart, V. L. Miller, C. W. Nessell, S. I. Rottmayer, R. T. Schoerner, O. H. Storey, Jr., R. K. Thulman.

Group B—Heat Transfer Between the Panel and the Space: J. M. van Nieukerken, Chairman; C. O. Mackey*, Vice Chairman; C. M. Ashley, W. P. Chapman, W. S. Harris, Linn Helander, E. S. Howarth, A. T. Jorn, C. F. Kayan*, L. J. LaTart, H. A. Lockhart*, W. E. Long, R. L. Maher, R. A. Miller, G. L. Wiggs.

Group D—Controls: E. F. Snyder, Jr.*, Chairman; A. B. Algren, H. W. Alyea, Louis Bartus, S. D. Browne, O. P. Bullock, J. A. Deubel, C. A. Gustafson, W. J. Hajek, W. H. Kliever, H. T. Kucera, J. S. Locke, J. F. McCauley, J. F. Page, L. C. Plaehn, J. K. M. Pryke, A. O. Roche, Jr., C. W. Signor.

Physiological Research: M. K. Fahnestock, Chairman; R. W. Keeton*, M.D., Vice Chairman; Lester T. Avery, Thomas Bedford, H. S. Belding, William Bruce, A. C. Burton, A. P. Gagge, Nathaniel Glickman, F. K. Hick, M.D., John W. James, R. D. Madison, P. J. Marschall, Sid Robinson, C. L. Taylor, T. L. Willmon, M.D., C.-E. A. Winslow.

Plant and Animal Husbandry: A. J. Hess, Chairman; H. A. Lockhart*, Vice Chairman; A. B. Algren, H. A. Borthwick, Samuel Brody, John Everetts, Jr*, F. G. Gustafson, S. R. Lewis, H. H. Mitchell, K. V. Thimann, W. G. Whaley, R. B. Withrow, H. E. Ziel.

Sensations of Comfort: C. S. Leopold, Chairman; E. F. Snyder, Jr.*, Vice Chairman; Lester T. Avery, John Everetts, Jr.*, M. K. Fahnestock, Nathaniel Glickman, A. J. Hess.

Sorption: G. L. Simpson, Chairman; John Everetts, Jr.*, Vice Chairman; G. C. F. Asker, O. D. Colvin, F. C. Dehler, W. E. Emley, Jr., A. S. Gates, Jr., E. W. Gifford, E. R. McLaughlin.

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Standards: P. B. Gordon, Chairman; F. H. Faust (three years); R. S. Dill, J. C. Fitts, (two years); K. T. Davis, S. H. Downs (one year).

ASHVE Committee on Code for Testing and Rating Heavy Duty Furnaces: E. K. Campbell, Chairman; Bowen Campbell, R. S. Dill, A. P. Loeb, C. J. Low, W. J. MacGirl, B. F. McLouth, F. L. Meyer, L. G. Miller, A. A. Olson, H. A. Pietsch, O. J. Ress, H. A. Soper.

ASHVE Committee on Safety Regulations for Heating, Ventilating and Air Conditioning Systems: G. P. Nachman, Chairman; F. H. Buzzard, H. W. McKenzie, B. F. McLouth, C. H. Randolph.

Joint Committee on Standards for Comfort Air Conditioning: W. L. Fleisher, Chairman, (ASHVE) O. W. Armspach, A. C. Buensod, C. C. Cheyney; (ASME) C. F. Kayan; (ASRE) F. H. Faust, C. F. Holske, J. A. Schurman; (ARI) M. M. Lawler, R. A. Gonzalez; Alternate: J. R. Schreiner; (U.S. Public Health Service) W. C. Cooper, M.D.; At Large: M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton; (Medical Profession) R. W. Keeton, M.D., W. J. McConnell, M.D.

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Engineers' Joint Council: L. E. Seeley (ASHVE Representative).

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NRC-National Academy of Sciences, Div. of Engrg.: B. H. Jennings.

To Codify Council Policies: J. H. Fox, Chairman; I. W. Cotton, A. W. Edwards, B. H. Spurlock, Jr.

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Nominating: M. S. Wunderlich, Minneapolis, Chairman; John Bonner, Cambridge, Mass., Vice Chairman; A. O. Roche, Indianapolis, Secretary; J. F. Collins, Jr., Pittsburgh; G. T. Donceel, Oklahoma City; Fred Janssen, Denver; R. L. Kent, Winnipeg, Man.; G. A. Linskie, Dallas; H. G. S. Murray, Montreal, Que.; H. E. Russell, Middletown, Ohio; W. O. Stewart, Los Angeles. Alternate: T. C. Caskey, Seattle.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(57 Chapters; 1 Special Branch; 8 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARIZONA:** 1953. Hdqrs., Phoenix. Meets, First Monday. PRESIDENT, V. J. Carns, 3602 No. 15th Dr. SECRETARY, A. J. Nelesen, Jr., 6744 No. 14th Pl.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, R. E. Blaylock, 509 E. Markham St. SECRETARY, J. L. Brown, 212 Terminal Warehouse Bldg.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, J. M. Lazenby, 8 11th St., N.E. SECRETARY, F. W. Bull, 1205 Spring St., N. W.

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. H. Taze, 33 E. 21st St. (18). SECRETARY, R. F. Weisman, 4650 Reisterstown Rd., (15).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. Meets, Second Wednesday. PRESIDENT, S. C. Gale, 1628 W. 4th Ave. SECRETARY, D. A. English, 1606 W. 1st Ave. (9).

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. D. Putnam, 115 Pulsifer Dr., Auburn. SECRETARY, Merle Weninger, 230 Goodrich Ave. (5).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT J. A. Guy, 478 W. Fifth Ave. (1). SECRETARY, W. A. Schoonover, 2901 N. High St. (2).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, F. W. Wilson, 222-24 E. 14th St. SECRETARY, R. G. Anderson, 1758 Elmore St. (23).

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, C. L. L'Hommedieu, 76 Blatchley Ave. SECRETARY, Walter Heywood, 14 Hartt Lane, Newington.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, C. V. Bankston, 2927 Jackson Ave. (25). SECRETARY, W. B. Martin, Jr., 2014 Rendon St. (15).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. Meets, Second Wednesday. PRESIDENT, E. C. Doyle, 315 Washington Ave. SECRETARY, H. F. Kruger, 501 Seventh Ave., Troy.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, Eric Roberts, 417 Market St. SECRETARY, F. K. Crouch, 906 Cerrito St., Albany (6).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, George V. Zintel, 840 N. Michigan Ave. (11). SECRETARY, H. G. Gragg, 228 N. LaSalle St. (1).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, P. O. Patterson, 2701 Roosevelt Ave. SECRETARY, A. O. Roche, Jr., 3950 Broadway (5).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, H. A. Bickel, E. 7 Riverside Ave. SECRETARY, Max Tonn, S. 4021 Latawah St.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, W. E. Nanes, 220 Davidson Bldg. SECRETARY, D. E. Schroeder, 2717 Cambridge.

● **KANSAS:** 1951. Hdqrs., Wichita, Kan. Meets, Tuesday after First Monday. PRESIDENT, Charles Yoe, P.O. Box 2239. SECRETARY, T. L. Roberts, 2008 S. Parkwood Lane.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, F. K. Ladewig, 3527 Broadway (11). SECRETARY, R. M. Spencer, 1510 Main St. (8).

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Fourth Thursday. VICE PRESIDENT, G. C. Davis, 142 Erin St. SECRETARY, G. T. Christie, Midland & Notre Dame.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. W. Sprague, 108 Cummington St. SECRETARY, W. G. Burbo, 137 Newbury St. (16).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, A. W. Shelby, 972 Union Ave. SECRETARY, A. T. Bevil, 1638 Union Ave. (4).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, John Schweiger, 593 Acorn Drive, (9). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, E. F. Glanz, 1761 W. Forest Ave. (8). SECRETARY, J. H. Spitzley, 1200 Fort St., W. (26).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, J. A. Craig, 814 South Ninth St. (4). SECRETARY, E. T. Erickson, 500 Baker Arcade (2).

● **MISSISSIPPI:** 1953. Hdqrs., Jackson, Miss. PRESIDENT, I. E. Rowe, 120 Georgia St. SECRETARY, M. E. Price, 205 Arbor Hill Dr.

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, D. L. Lindsay, 4350 Sherbrooke St. (6). SECRETARY, S. R. Plamondon, 2267 Melrose Ave. (14).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, C. A. Goth, 3115 N. 49th Ave. SECRETARY, L. J. Paulsen, 1901 S. 39th St.

● **NEW MEXICO:** 1954. Hdqrs. Albuquerque, N.M. PRESIDENT, J. H. Van Alsburg, 1330 Cerro Gordo, Santa Fe. SECRETARY, J. K. James, 4462 Avenida del Sol.

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, R. L. Stinard, 51 E. 42nd St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH JERSEY:** 1952. Hdqrs., Newark, N. J. Meets, Second Tuesday. PRESIDENT, H. M. Patrick, 20 Olcott Ave., Bernardsville. SECRETARY, W. C. Kruse, Jr., 40 E. Park St. (2).

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, M. W. Brown, 1213 Texas Bank Bldg. SECRETARY, H. G. Gregerson, 2921 Fairmount.

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, R. W. Winget, 2428 E. 11th St., Box 100. SECRETARY, J. T. McKinney, 1341 So. Boston.

● **NORTHERN OHIO:** 1916. Hdqrs. Cleveland, Ohio. Meets, Second Monday. PRESIDENT, D. E. Mannen, 9104 Woodland Ave. (3). SECRETARY, H. R. Canoyer, 1900 Superior Ave., Bay Village.

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. Meets, Second or Third Friday. PRESIDENT, R. B. Crosland, Jr., 1001 S. Marshall St., Winston-Salem. SECRETARY, W. H. Cooper, 1001 S. Marshall St., Winston-Salem.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, G. E. Ervin, 2800 N. Oklahoma St. (5). SECRETARY, F. R. Denham, 320 Oklahoma Natural Bldg.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, M. C. Bailey, 1139 Bay St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, E. E. Kelly, 4504 S.W. Corbett Ave. (1). SECRETARY, K. N. Flocke, 3027 N.E. 31st Ave. (12).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. Meets, Third Tuesday. PRESIDENT, W. J. Robinson, 1174 Wellington St. SECRETARY, N. J. Howes, Box 264, R.R. 1.

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, T. C. Caskey, 11642—26th Ave., So. (88). SECRETARY, E. W. Triol, 407 Medical Arts Bldg.

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, L. M. Church, 12 So. 12th St. (7). SECRETARY, C. J. Forve, Parkwood Manor, Apt. B-202, State Rd. & Penarth Ave., Upper Darby.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, E. C. Hach, 221 Broadmoor Ave. (34). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, H. L. Wray, 1101 Geneva St., Aurora. SECRETARY, J. F. Cipra, Jr., 2676 S. Madison St.

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. Meets, First Wednesday. PRESIDENT, E. C. McKinsey, 4220 Annette (21). SECRETARY, R. A. Sarro, 5412 Argo Way.

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, G. H. Bemarkt, St. Clair Dr., R.R. 1, Caseyville. SECRETARY, W. P. Norris, 1118 Fullerton Bldg.

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, J. S. Malahy, Jr., 1839 Line Ave. SECRETARY, H. E. Scott, 2502 Woodford St.

● **SOUTH CAROLINA:** 1954. Hdqrs., Columbia, S. C. PRESIDENT, R. F. Donovan, P.O. Box 3053. SECRETARY, J. E. McMurray, 1639 Blanding St.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, E. G. Floeter, Jr., P.O. Box 1657 (1). SECRETARY, F. M. Neil, 3513 W. Dallas Ave. (19).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, C. D. Walz, 3600 San Pasqual St., Pasadena (10). SECRETARY, H. F. Ulovec, 3886 Olympiad Dr. (43).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. S. Fullerton, P.O. Box 3697. SECRETARY, J. R. Clark, P.O. Box 1755.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, L. H. Hornor, Jr., 816 Insurance Bldg. SECRETARY, Boone Crisp, P.O. Box 9065, (4).

● **UTAH:** 1944. Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, M. L. Gollaher, 1163 Roosevelt Ave. (5). SECRETARY, G. L. Soderborg, Sr., 42 E. 8th St. S.

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, H. E. Marquart, 111 W. Main St. SECRETARY, R. L. Burton, Jr., 1913 Lafayette Blvd.

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. C. F. Asker, 1109 W. Broad St., Falls Church, Va. SECRETARY, C. P. Humke, 5905 Berwyn Rd., Rt. 1, Box 89, College Park, Md.

● **WEST TEXAS:** 1953. Hdqrs., Lubbock, Tex. PRESIDENT, L. C. McKay, 210 Sanford Bldg. SECRETARY, J. C. Wharton, Box 1240.

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, F. W. Brundage, 512 N. Park St., Kalamazoo (11). SECRETARY, F. L. Murray, 482 W. Michigan Ave., Battle Creek.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, Q. P. Thompson, 260 Richmond Ave. (22). SECRETARY, G. E. Kuhn, 475 Woodland Dr., Kenmore (23).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, L. C. Plaehn, 914 N. Broadway (2). SECRETARY, H. W. Alyea, 507 E. Michigan St. (2).

SPECIAL BRANCH

● **SWITZERLAND:** 1952. Hdqrs., Zurich. PRESIDENT: Walter Sennhauser, Sulzer Bros., Ltd., Winterthur. SECRETARY, Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Norman Falbaum, Box 4668, State College Station. SECRETARY, J. L. Flowers, Apt. 33-E, Vetville.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, C. E. Durrett, 1215 College. SECRETARY, R. M. Jauch, 308½ W. Maple.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, R. E. Bulletsel, 252 Kings Rd. SECRETARY, I. P. Parkhurst, 1354 Harrison.

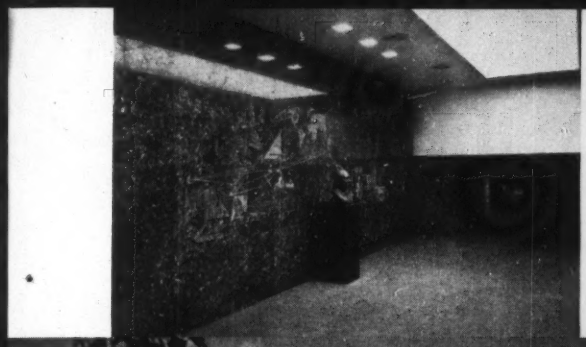
● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, E. B. Katz, 415 State St. SECRETARY, R. A. Chambers, 248 Littleton.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station, Tex. Meets, Second and Fourth Tuesday. PRESIDENT, D. F. Carroll, Box 6264. SECRETARY, C. W. Farrar, Jr., Rt. 1, Box 339, Bryan.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, J. R. Cairns, 4001 Florence, (21). SECRETARY, W. E. Zimmerman, 15359 Lauder (27).

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, Alexander Tudor, 75 South Dr. SECRETARY, T. M. Devine, More House, St. Michaels College.



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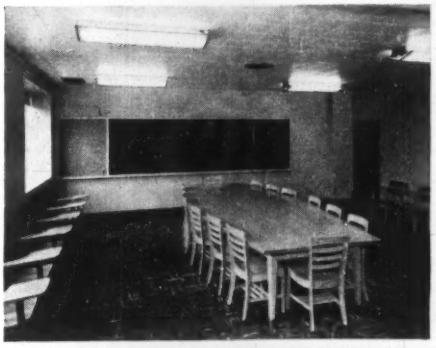
Contractor— Dravo Corporation

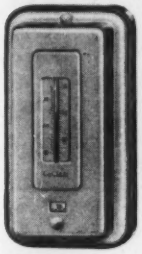
Below: Conference Type Classroom



Below: Reading Room and Interconnecting Lounge

POWERS

Pneumatic System of
TEMPERATURE CONTROL



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Comfortable Room Temperatures in modern buildings like this are important. Here the time tested and modern features of a Powers **Pneumatic** Control System assure maximum fuel savings and 25 to 40 years of dependable control with lowest expense for upkeep.

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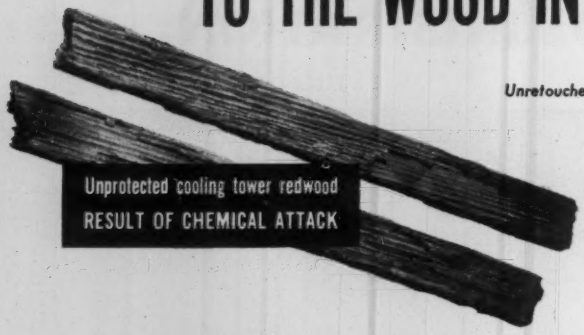
(b41)

LOOK WHAT CAN HAPPEN TO THE WOOD IN COOLING TOWERS

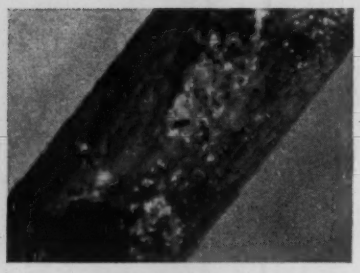
Unretouched photographs



Unprotected cooling tower redwood
RESULT OF CHEMICAL ATTACK

Unprotected cooling tower redwood
RESULT OF FUNGUS ATTACK

PRESSURE CREOSOTING ADDS YEARS OF LIFE TO HALSTEAD & MITCHELL COOLING TOWERS



FUNGUS ROTTED UNPROTECTED DECKING

Unretouched photographs

CLEAN PRESSURE-CREOSOTED DECKING

Examine these unretouched photographs carefully. Constantly wetted wood decking in a cooling tower is subject to immediate attack by fungus and marine parasites. It is also subject to chemical deterioration from acids in water. All wood used in Halstead & Mitchell Cooling Towers is protected against these twin enemies.

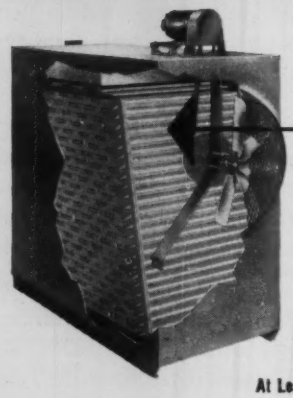
WHY PRESSURE CREOSOTING?

Creosote . . . *with 162 elements toxic to fungus growth and parasites* . . . also makes wood more resistant to chemical attack. Deep penetration of the wood by Koppers Pressure-Creosoting gives the longest possible wetted decking life. Therefore, all Halstead & Mitchell Cooling Tower decks are Pressure-Creosoted, and are guaranteed against rotting due to fungus growth . . . for 20 years!

ONLY HALSTEAD & MITCHELL OFFERS THE

20-Year Guarantee!

ON THE WETTED DECK SURFACE against rotting by fungus attack



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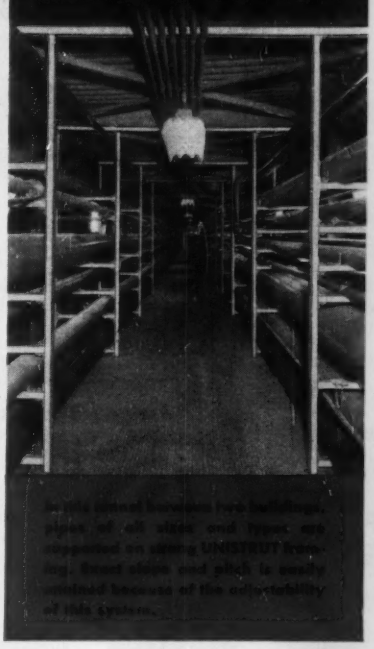
Supporting piping in difficult places is easy to accomplish with adjustable UNISTRUT framing. Note the many different arrangements and angles supported. Pipe clamps, too, are part of the UNISTRUT system.

VERSATILE SYSTEM INSTALLS QUICKLY, ON THE JOB...SAVES TIME AND MONEY FOR ELI LILLY AND COMPANY

Complicated piping such as in the Eli Lilly and Company pharmaceutical plant at Indianapolis, Indiana, required supporting capable of working in difficult spots, around corners, bends...a supporting that could be put up quickly, yet economically.

UNISTRUT framing was the ideal solution. For this quick-erected system is simply cut and bolted together, custom fit to the job. No welding, drilling or skilled labor required. UNISTRUT framing reduces engineering detailing and installation time. And it is completely adjustable, permitting alterations or changes at any time.

Supporting shown here was erected from stock channel, fittings, beam clamps, pipe rollers—all part of the complete UNISTRUT framing system. This versatile framing method will save you hours and dollars on thousands of mechanical and electrical supporting jobs. See your UNISTRUT Distributor for complete details, or send the coupon for a free copy of the UNISTRUT handbook.



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USE A HACKSAW AND WRENCH

NO DRILLING, NO WELDING

100% ADJUSTABLE AND RE-USABLE

Bring UNISTRUT to your door—
Ask to see our demonstrator car.

The World's Most Flexible All-Purpose Metal Framing

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U. S. Patent Numbers
2327587 2329815 2345650
2363382 2380379 2405631
2541908 Other Patents Pending

SEE OUR CATALOG IN SWEET'S

Warehouse stocks and distributors in all principal cities. In Canada, Northern Electric Company. For Export, Pressed Steel Car Company, New York, N. Y. Consult your telephone directories.

Free Handbook!
84 pages, electrical and mechanical installations with UNISTRUT framing.

UNISTRUT PRODUCTS COMPANY, Dept. H-8
1013 W. Washington Blvd., Chicago 7, Illinois

Name.. .....

Company.....

Address.....

City.....*Zone*....*State*.....

When something's got to give
to compensate for expansion,
contraction, vibration, rotation or strain,
in your piping system or equipment,
it will be far, far better for you
if the "something" that gives
is a Zallea Expansion Joint
and not your expensive piping.
Since piping damage usually
means down-time, it pays
to provide positive, over-all protection.

The expansion joints illustrated,
duo-equalizing, hinged, and universal,
are just a few of the Zallea family
of expansion joints available
to help solve your piping problems.

Regardless of piping movement,
whether axial, lateral, rotational,
etc., Zallea already has, or will
design, an expansion joint to absorb it.
For information on standard types,
request Bulletin 351. For consultation
on special problems, ask us to
have our representative call.

Zallea
expansion joints

ZALLEA BROTHERS, 816 LOCUST ST., WILM'NGTON 99, DEL.

World's Largest Manufacturers of Expansion Joints

A pipe dream come true!

Made in pre-formed sections, new Fiberglas Low Pressure Pipe Insulation is easily and economically applied. Comes in sizes to fit standard pipe up to 12", all copper tubing up to 3" in diameter. Suitable finishes, including vapor barrier jackets for cold line anti-sweat purposes, *are factory applied.*

New, rot-proof, shrink-proof, high thermal efficiency

FIBERGLAS* LOW PRESSURE PIPE INSULATION

for low pressure steam lines, hot and cold water lines!

The problem is solved—no more rotting, shrinking, adsorbent, *costly* insulation on your low pressure steam lines, your hot and cold water lines!

New Fiberglas Low Pressure Pipe Insulation is here—the first major improvement in low pressure pipe insulation in over 30 years—tested and proved in three years of trial applications!

Made of inert fibers of glass, this pipe dream come true will not rot, shrink, swell, buckle, or sag. It's lightweight, resilient, moisture resistant, *and up to 50% more efficient thermally than old insulations used in low pressure service.* Best of all . . .

New Fiberglas Low Pressure Pipe Insulation is priced right in line with ordinary insulations!

Which means that for any given installation it's actually cheaper. For thanks to higher efficiency, ½" of Fiberglas Low Pressure Pipe Insulation does the same insulating job on hot piping as 1" of less efficient old type insulation—and it lasts and lasts. The properly located vapor barrier (on outside of insulation) helps avoid condensation, adsorption and resultant corrosion of pipe and deterioration of insulation.

Whatever the application—low pressure steam, hot water or anti-sweat for cold water lines—Fiberglas Low Pressure Pipe Insulation pays for itself time and time again. Moreover, it's easy to cut and handle, fast and economical to install.

Mail coupon now for new 4-page bulletin giving full technical data!

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FIBERGLAS

*T. M. Reg. U. S. Pat. Off.

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Dept. 40-H
Toledo 1, Ohio

Please send me a free copy of your new 4-page technical bulletin on new, rot-proof, shrink-proof, high efficiency Fiberglas Low Pressure Pipe Insulation.

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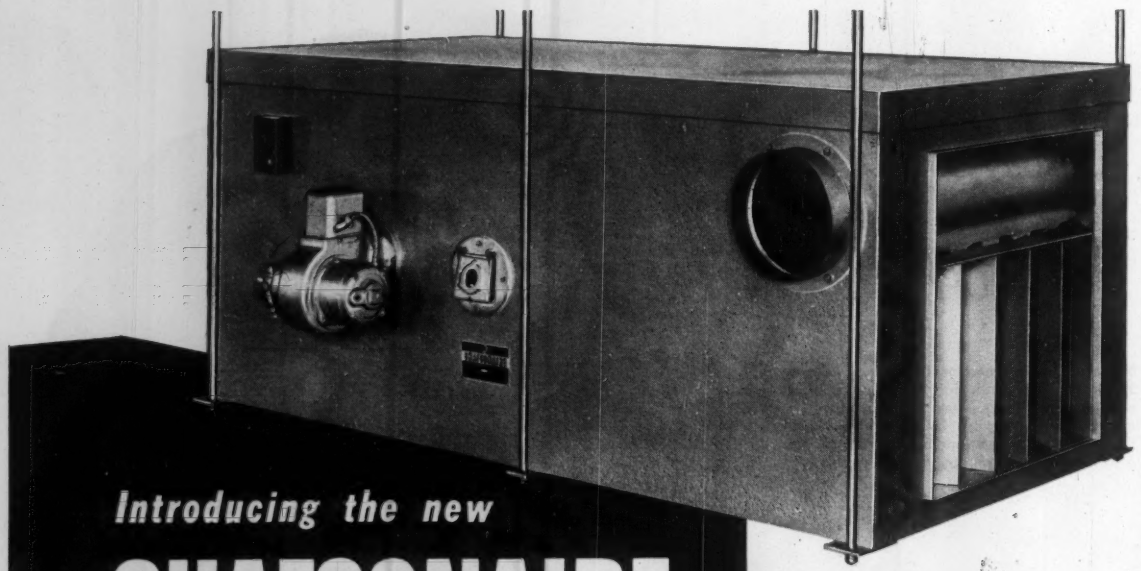
City.....**Zone**.....**State**.....



Introducing the new

SHAFCONAIRE

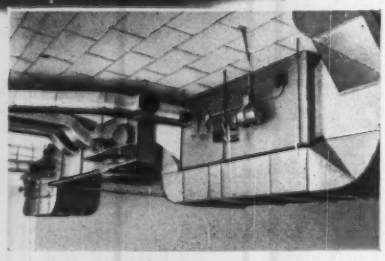
DUCT HEATER

the only Oil Fired Unit designed for use in central air conditioning systems!

At last . . . a compact, oil-fired duct heater designed to tie-in with blower units of central air conditioning systems! Custom engineered to handle the proper CFM air flow, the new Shafconaire Duct Heaters use new air foil louvres to balance the distribution of air over the heat exchanger . . . always assure correct air velocity!

By eliminating a heavy blower assembly in the heater itself, Shafconaire heaters have a lower initial cost. They cost less to install . . . use far less space, too! Available in models of 100,000 to 400,000 B.T.U. output, new Shafconaire Duct Heaters retain all the high heating efficiency and low operating cost of regular Shafconaire Overhead heaters, as well as all the quality features, too! You'll find the same heavy duty construction, built-in plenum chamber, efficiency-engineered heat exchanger and intermediate heat travel section!

Write today! Get the facts on new Shafconaire Duct Heaters for your next air conditioning job. Proven by over three years in the field, you'll find they are best . . . by design!



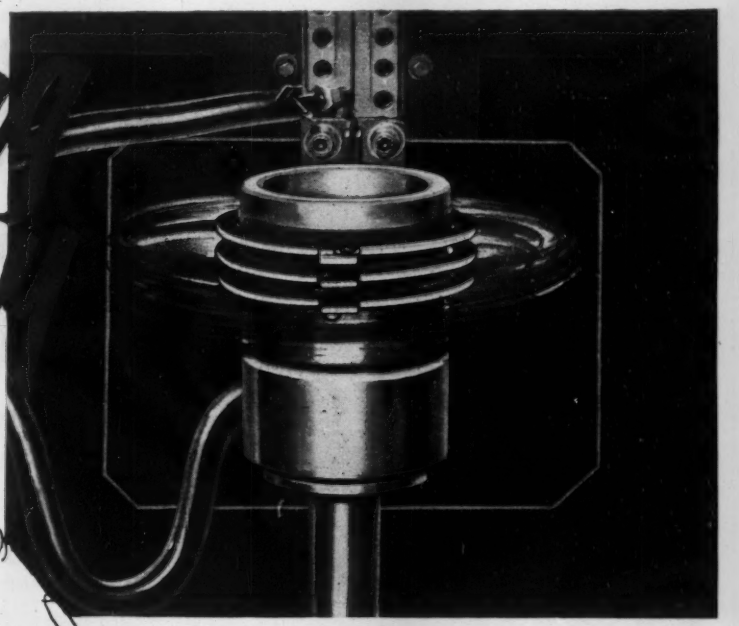
National Food Store Supermarket, Detroit, Mich., uses Shafconaire oil-fired duct heaters with year-round air conditioning system. Overhead position leaves premium floor space available. Units engineered to utilize air conditioning blower assembly.

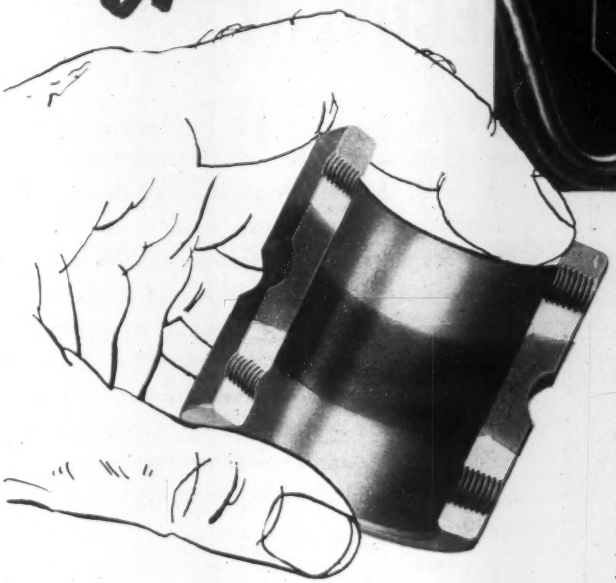
SHAFCONAIRE
OverHead Heaters

OverHead Heaters, Inc.

1614 BOOK BUILDING • DETROIT 2, MICHIGAN • WOodward 2-4647

Blazing the wa





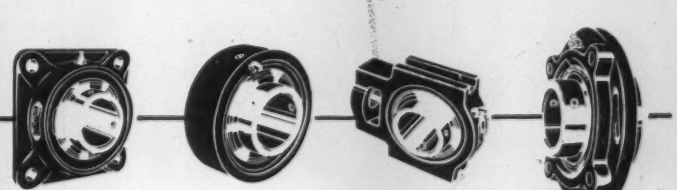
to greater bearing performance!

Here's another SEALMASTER patented exclusive in action! *Zone Hardening* is another in a long history of advances that includes: the *first* self-aligning, permanently-sealed industrial ball-bearing unit . . . the *first* outer-race locking pin . . . the *first* ball retainer riding the inner surface of the outer-race ring . . . all patented features! *Zone Hardening* is a completely automatic heat treating process by which the inner-race ring of SEALMASTER Ball Bearing Units are hardened through the ball path and adjacent section only. The extended portion of the inner-race is left in its original metallurgically soft, tough state. Hardened set-screws are mounted through this soft portion of the race, permitting race-to-shaft locking with increased holding power and greater resistance to vibration and shock. Firm lock of bearing to shaft minimizes danger of fretting corrosion and eliminates shaft wear.

This new feature is available on all SEALMASTER Bearing Units which includes a complete line of standard housings, as well as, numerous special designs.

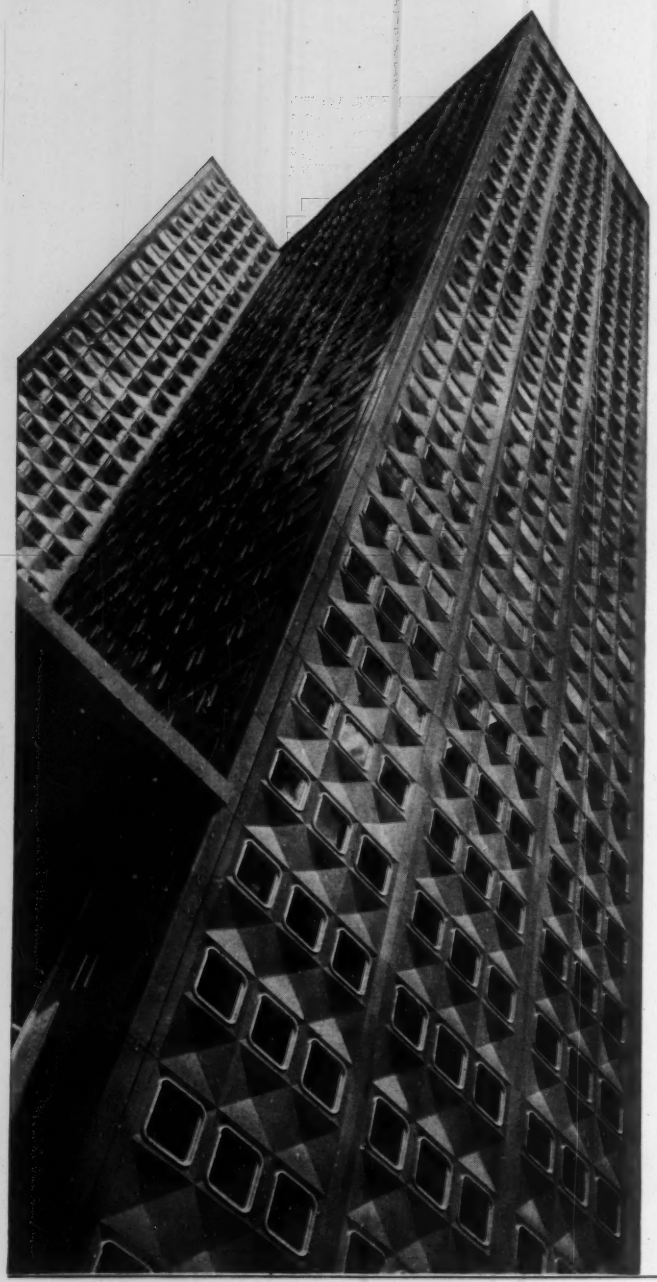
For your copy of Catalog 454 call your SEALMASTER Distributor or write the factory:

SEALMASTER
BALL BEARING UNITS



SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG. CO.
47 RIDGEWAY AVENUE, AURORA, ILL.

ALCOA SAVES WITH DOREX AIR RECOVERY



● For its new building in Pittsburgh, Aluminum Company of America uses an air conditioning system that is only about one-half the size of conventional ventilating systems. Dorex Air Recovery plays an important part in this saving.

Dorex Air Recovery is a simple method for "reconditioning" used air—making it completely odor-free and fresh for re-use. This sharply reduces the amount of outside air that has to be taken into the system and, as Alcoa knows, reduces the size and costs of heating and cooling equipment; and offers continuing savings in operating costs.

In fact, averages, drawn from more than twenty years' experience with over 10,000 Dorex installations, show that every $100 invested in Dorex Air Recovery should return about a $400 saving in original ventilating equipment...and every $1 spent for Dorex maintenance should save some $4 in operating costs.

Find out more about Dorex Air Recovery—what it has done for others, what it can do for you. A note on your letterhead will bring full information promptly. Connor Engineering Corporation, Danbury, Connecticut.

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dorex® air recovery

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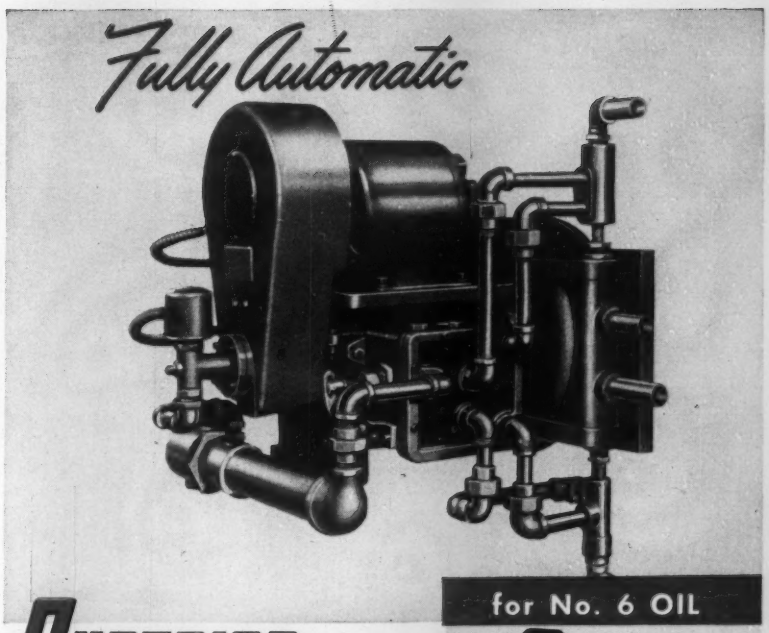

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. . . provide dependable manual, semi-automatic, or fully automatic operation . . . burning light or heavy oils, natural or manufactured gas. For new installations and conversions in all types of heat receivers; for heat, process steam or power.

Developed primarily to achieve the complete combustion which results in the highest efficiencies with the greatest economy of fuel, these rugged burners insure years of dependable trouble-free operation. For complete details write for Catalog 1604.

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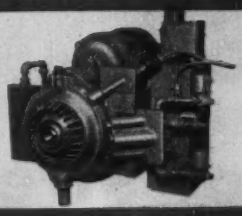

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Note **THESE SOUND FUNDAMENTALS:**

- Time-tested horizontal-rotary design.
- V-Belt Drive for the high cup speed essential to efficient atomization.
- Four-Hole Hinge circulates oil through oil heater so that hot oil is on the *pressure* side of the pump, allowing you to burn oil at higher temperatures.
- Adjustable Air Nozzle provides accurate control of flame contour.
- Dual Pumps and Reservoir combined with Constant Oil Rate Control provide controlled firing regardless of viscosity variation.
- Burn any grade of oil. Also available with combined gas burner for any type of gas.
- Fully automatic in sizes to 500 bhp with dual ignition, and hi-low or fully modulating control.

for performance you can **BANK** on

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For Strength and Stiffness Nothing Beats Galvanized Steel

Look at each of the materials commonly used for ductwork, and you realize the strongest and stiffest of them all is steel.

That's why a galvanized steel sheet has less tendency to buckle or kink in handling. Less bracing is needed. Longer unsupported sections can be used. And there is better resistance to damage from rough handling.

Bethlehem galvanized steel sheets are made from strong, durable steel, either plain or copper-bearing. Tight, uniform zinc coating guards them against corrosion. They are easy to cut, form, seam and solder. And they give a bright, clean look to any kind of sheet-metal job.

Bethlehem GALVANIZED Steel Sheets

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
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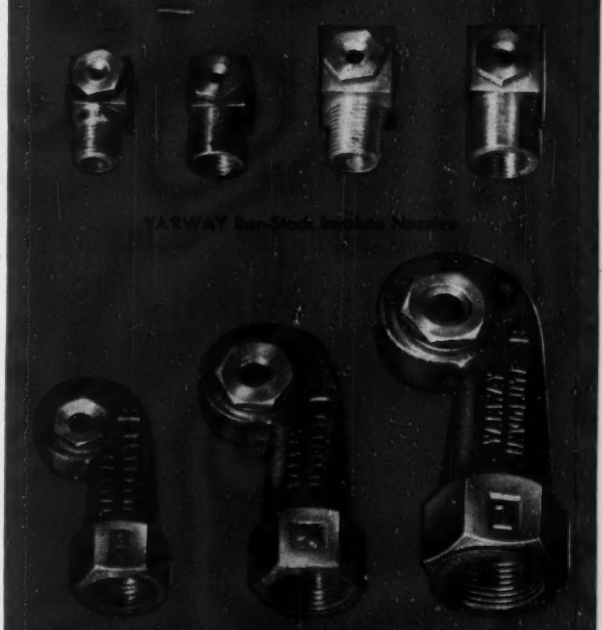
★ BETHLEHEM STEEL ★

reach a new peak with YARWAY

in spraying efficiency non-clog nozzles



YARWAY Bar-Stock Involute Nozzles

YARWAY Type B Involute Nozzles

cone spray

Most popular design for cooling, recooling, washing, rinsing, air conditioning, drying and other spraying operations in industrial and processing work and in power plants.

Non-clog involute design has no internal parts (vanes or deflecting plates) on which foreign particles can collect. Special contour of nozzle body guides flow with minimum loss of energy towards discharge opening, where liquid attains maximum velocity and leaves nozzle in a fine hollow-cone spray.

Available in three types:

Bar-stock bronze (shown) for fine spray
Sizes ¼" and ⅜", male or female connection
Capacities up to 3 gpm; pressures 20 to 50 psi

Cast bronze Type B (shown) for air conditioning and small recooling systems
Five sizes, ½" to 1½"
Capacities up to 40 gpm; pressures 7 to 25 psi

Cast bronze Type C (not shown) for spray pond service
Sizes 2" and 2½"
Capacities up to 110 gpm; pressures 7 to 15 psi

Write for YARWAY Spray Nozzle Book N-617; it gives capacities, dimensions and application information.

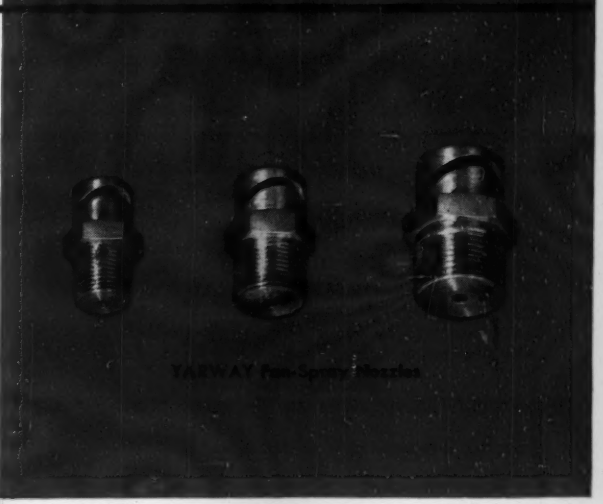
fan spray

Preferred for many washing and cooling operations. Non-clog design, delivers flat fan-shaped sheet of spray with slicing action particularly desirable for surface washing.

Thin sheet of spray is discharged forward 30° from the vertical, spreading in fan shape up to 140°, depending on operating pressure.

Made of bronze, steel or other bar-stock metals, male thread, six sizes ⅛" to 1", capacities up to 7 gpm, pressures up to 50 psi.

Write for YARWAY Spray Nozzle Book N-617.



YARWAY Fan-Spray Nozzles

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

YARWAY® **spray nozzles**

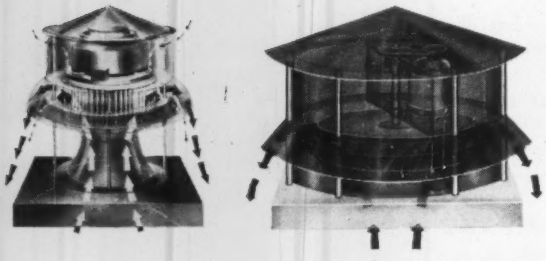
Nobody buys generators on the basis of voltage alone

Buying power roof exhausters on the basis of cubic feet per minute alone is just as ridiculous

When you buy a generator you want to know the wattage because it tells how much work can be performed against various resistances. The same is true of power roof exhausters, you should know how many CFM at a given static pressure because this is the *true* indication of actual performance.

Gallaher units with built-in scroll effect develop up to 4" S.P., a figure unapproached by any other power roof exhauster. Performance data is the result of actual physical tests of the unit. Gallaher research indicates that unless scroll effect is present, efficiency against even normal static pressures are unlikely and that in actual test where ratings are predicted, instead of being physically tested, errors may run 50% or more.

It's the reason why so many engineers and architects are specifying Gallaher Air Vans® for almost every kind of industrial application where positive air removal is essential.



Gallaher Air-Vans®

Direct Drive (far left) develops up to 4" S.P. 150 to 11,000 CFM. Belt Drive develops to 4" S.P. 1,000 to 65,000 CFM.

Direct connected, low silhouette, weatherproof and extremely heavy construction.

For full information write

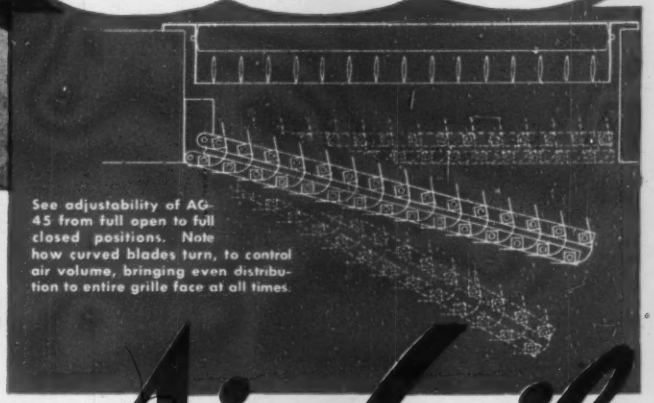
The GALLAHER Company

4108 Dodge St. Omaha, Nebraska

MANUFACTURERS OF POWER ROOF EXHAUSTER BASED ON DESIGN RESEARCH.

NEW ADJUSTABLE DOUBLE DUTY AIR VOLUME EXTRACTOR & CONTROLLER

FACTORY ASSEMBLY SAVES UP TO 50% OVER SLOW HAND-MADE METHODS



See adjustability of AG-45 from full open to full closed positions. Note how curved blades turn, to control air volume, bringing even distribution to entire grille face at all times.

11 TREMENDOUS ADVANTAGES:

1	FACTORY ASSEMBLED
2	INSTALLS WITH 2 SCREWS
3	Double Duty Extractor & Vol. Controller
4	Replaces Extra Vol. Controller
5	Equalizes Air Distribution & Air Flow
6	Turns Air from Main Duct
7	Reduces Pressure Losses
8	Stops Excess Turbulence
9	Low Cost
10	Rattle Free
11	14 & 20 Gauge Steel

Air Foil

AIR CONDITIONING OUTLETS

Slash unit costs with this amazing new Titus AG-45. Make it easy for yourself to *keep bids low.* Use this *cost saver* to beat competition. Eliminate the extra work of putting in volume controllers. Save time, labor. IMPROVE THE AIR CONTROL EFFICIENCY OF EVERY INSTALLATION. Get complete free information now. Order a sample AG-45 today. Remember, not until you have one of these AG-45s in your hand, can you see its *amazing cost-saving value.* IMMEDIATE DELIVERY.

Free

Check Type of Grille on Which Information Is Desired:

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Industrial grilles
- ☐ Special made-to-order grilles.

TITUS MANUFACTURING CORP., WATERLOO, IOWA

- ☐ RUSH information on AG-45 Extractor & Controller
- ☐ Send complete catalog
- ☐ Send literature on above checked items

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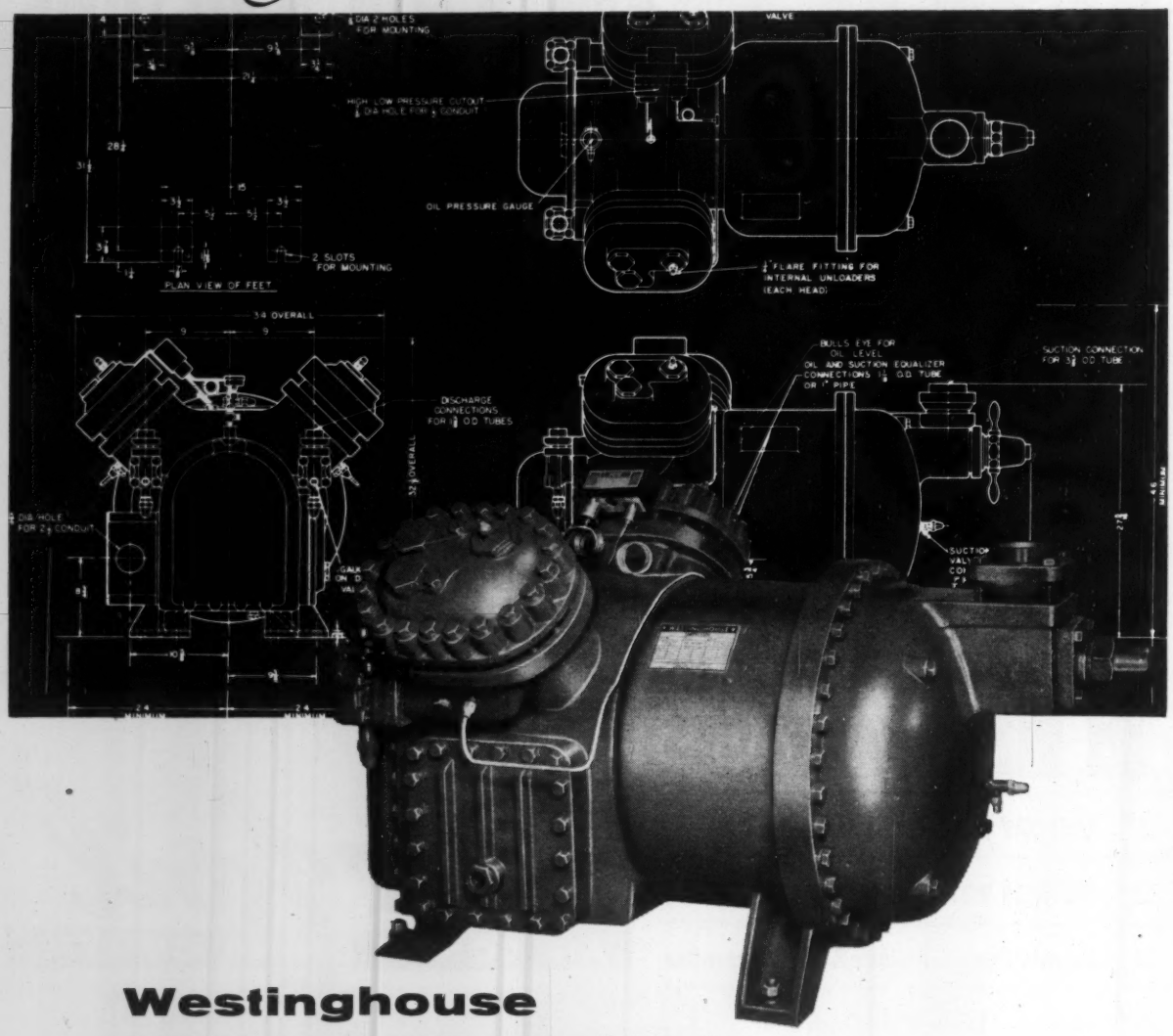
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Capitalize on Westinghouse advanced compressor engineering. Easier to sell, easier to install and easier to service, the Westinghouse compressor line meets every market need—and has unmatched market acceptance. It is precision-built to provide low operating cost, long life and trouble-free operation. The refrigerant-cooled integral *motor* needs no ventilation. Belts, pulleys and shaft seals are eliminated. Moreover, size and weight are kept to a minimum—to lower installation costs.

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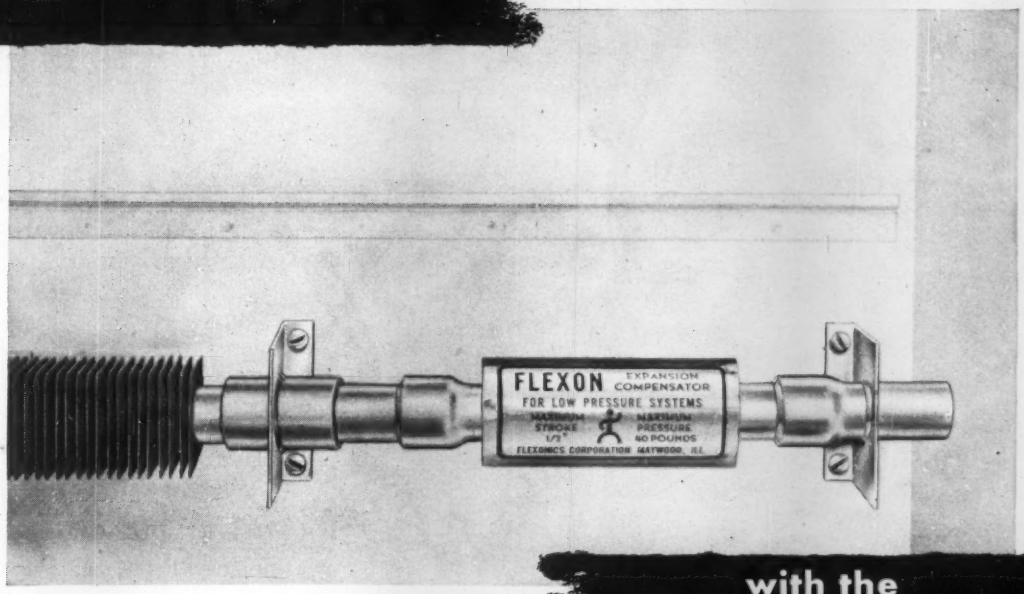
J-80388

STOP

expansion leakage and pipe creeping noises in steam and hot water heating systems



with the NEW FLEXON EXPANSION COMPENSATOR

DESIGN DETAILS

The Flexon Expansion Compensator consists of a two ply phosphor bronze bellows with copper tube end connections (sizes ¾″ to 1¼″) enclosed in a floating protective shroud of brass. All joints are electronically sealed with silver solder for long leak-proof life. The 2″ size has standard threaded fittings. Threaded fittings for other sizes are also available. A single compensator will handle total piping motion up to ⅝″ (½″ in compression, ⅛″ in extension). Suitable for temperatures from —60° F. to 250° F. and for pressures up to 40 psig.

Now, for the first time, there is a practical, economical answer to the problem of expansion control in low pressure steam and hot water heating systems—the new FLEXON Expansion Compensator. It is especially designed and manufactured for finned type convectors, baseboard, radiator or heating supply lines. The FLEXON Expansion Compensator absorbs thermal expansion and puts an end to the danger of leakage that often results from the stresses set up by uncontrolled expansion. At the same time it eliminates the pipe creeping noises that frequently accompany expansion. Important, too, is the fact that FLEXON Expansion Compensators are made to outlast the building in which they are installed. There is no maintenance . . . just put them in and forget them.

FLEXON Expansion Compensators are made in ¾″, 1″, 1¼″ and 2″ sizes. Contact your local distributor for further information, or use the coupon below to get the descriptive bulletin.

Flexonics *Corporation*

Flexon identifies products of Flexonics Corporation that have served industry for over 52 years.

EXPANSION JOINT DIVISION
1391 S. Third Avenue
Maywood, Illinois

Flexonics Corporation
1391 S. Third Ave.
Maywood, Ill.

Please send me the bulletin which describes and gives full specifications for the Flexon Expansion Compensator.

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Naturally! Since Powell makes more kinds of valves—and has probably solved more valve problems—than any other organization in the world. And Powell Valves have a record of dependable flow control since 1846.

Just name the kind of precision valve you need—Powell can supply it. Made ⅛" to 30" and 125 pounds to 2500 pounds W.S.P. Bronze, iron, steel and corrosion resistant alloys. Available through distributors in principal cities. On problems, write direct to The Wm. Powell Company, Cincinnati 22, Ohio.

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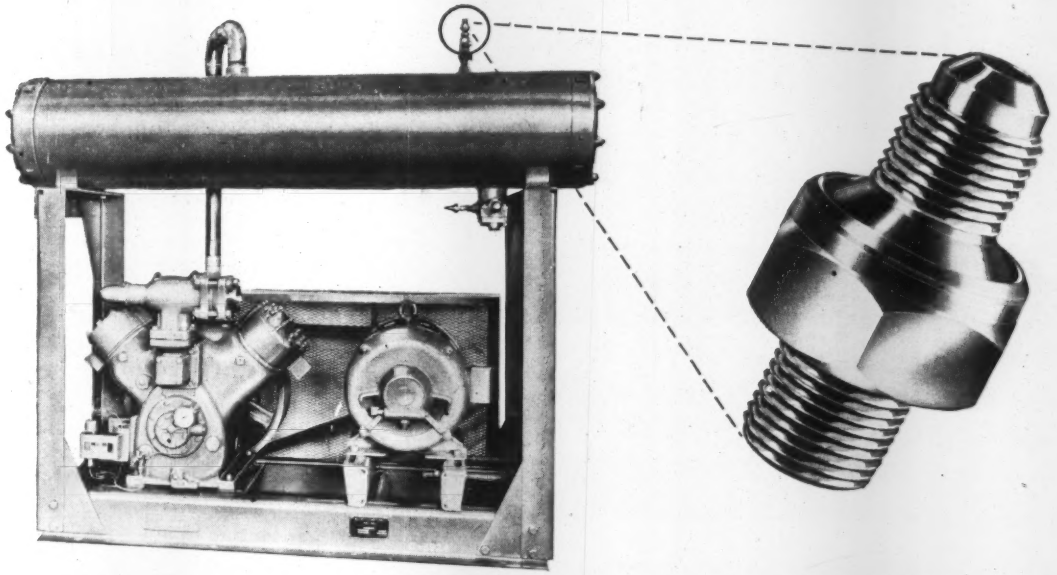
Powell Valves

108th year

Condenser Units Must Be PRESSURE-SAFE!



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THE "CIRCUIT-BREAKER" OF
Pressured Systems

All condenser units must have some kind of a pressure-relief device, it's true. But Worthington Corporation—a leading manufacturer of air conditioning equipment—wants to be *doubly* sure that its units will be safe from the dangers of overpressure under all operating conditions. That is why Worthington air conditioning condenser units are equipped with a *secondary* relief device... the BS&B SEALED TYPE SAFETY HEAD!

This low-priced "throw-away" SAFETY HEAD unit functions much like a fuse in your electrical system... in case of failure or malfunction of the primary relief device, the SAFETY HEAD is there to provide that *extra margin of safety* at a very nominal cost! Factory assembled and sealed, it is guaranteed leak-proof, and consists of a brass fitting containing a fine silver rupture disc which will rupture at a safe predetermined pressure to provide instantaneous and positive pressure relief. It may also be used as a primary relief device.

Thousands of BS&B SEALED TYPE SAFETY HEADS are now in service on many different types of pressured systems and equipment. If you are a manufacturer or user of such equipment, we suggest that you safeguard it with a BS&B SAFETY HEAD – the *non-mechanical* relief device! Available in a variety of types, pressure ratings and connection sizes. Investigate now! Descriptive literature and prices will be sent on request.

EFFICIENCY
OVER 60 YEARS
BS&B
RELIABILITY

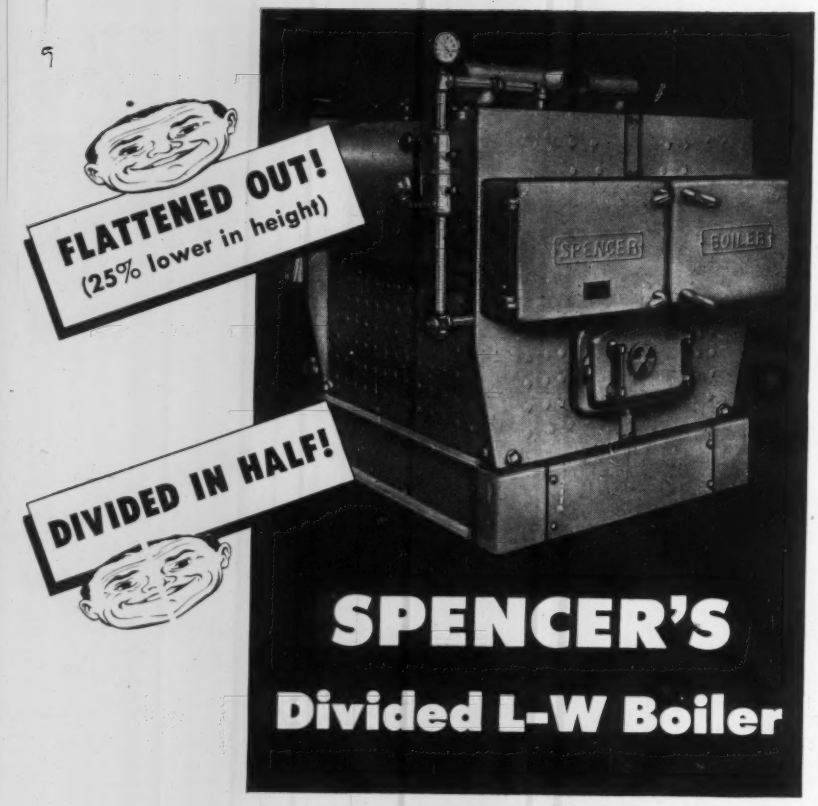
CODE ACCEPTED!

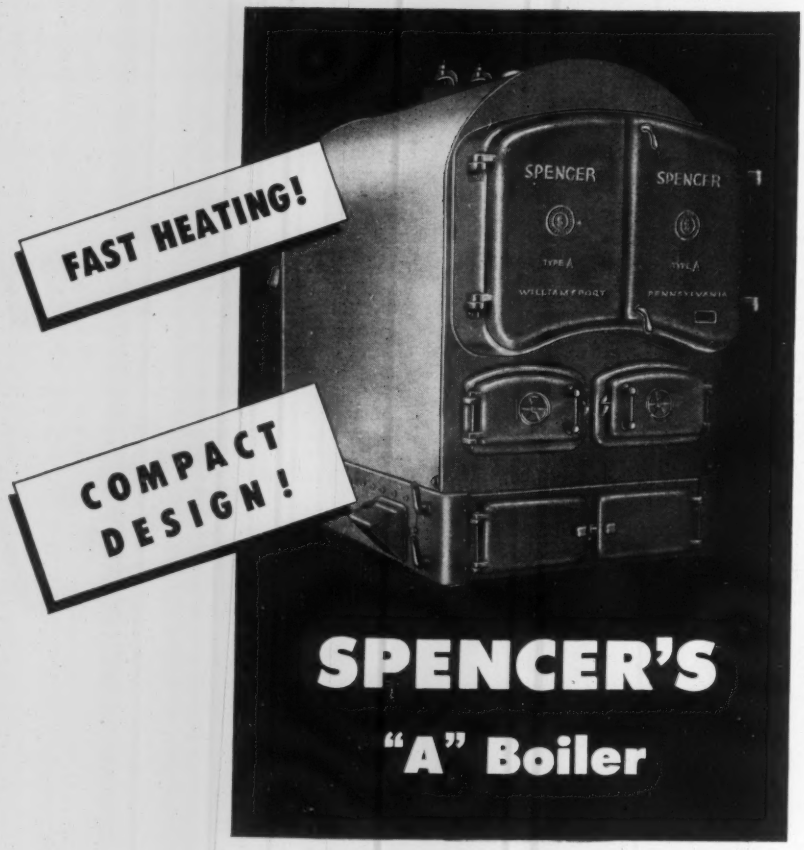
BS&B SEALED TYPE SAFETY HEADS comply with the standards established by the ASA B-9 Refrigeration Code, the ASA B-19 1950 Code and the ASME Unfired Pressure Code. Many cities are now requiring that air conditioning and refrigeration equipment be protected with safety devices which will comply with these code requirements.

Safety Head Division, Dept. 2-DZ8

BLACK, SIVALLS & BRYSON, INC.

7500 East 12th Street — Kansas City 26, Missouri





SOLVE

MAJOR HEATING PROBLEMS WITH ADVANCED SPENCER DESIGNS!

Unique Low-Waterline Boiler Solves Special Installation Problems

It's 25% lower than conventional boilers of the same capacity, solving low headroom problems in existing buildings . . . excavation problems in new buildings.

Divided in half, it can be moved—one watertight section at a time—through narrow doorways.

It features all the many design dividends that provide traditional Spencer top efficiency at low cost . . . can be adapted to any fuel . . . mechanical or hand firing.

Sizes ranging from 3,500 to 42,500 sq. ft., steam.

Durable Spencer "A" Series Cuts Installation Time . . . Provides Economical Heat

Unique flue-and-smokebox units save hours in installation time.

Compact design saves valuable floor space—takes less headroom.

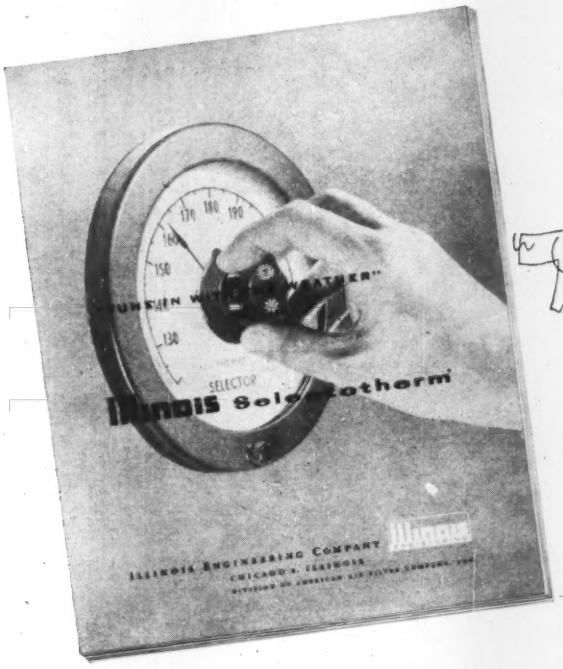
Special peaked firebox and staggered boiler tubes provide faster heating . . . more efficient heat transfer.

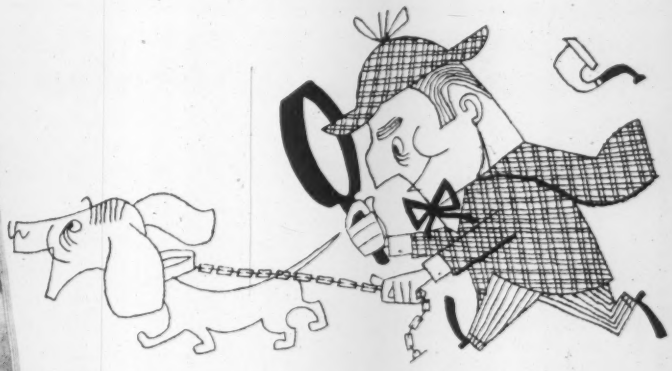
Available for stoker or hand firing . . . can be adapted to any fuel.

Sizes ranging from 3,500 to 42,500 sq. ft., steam.

SPENCER HEATER
LYCOMING DIVISION
WILLIAMSPORT avco PENNSYLVANIA

For information and specifications on Spencer's commercial boilers, write to: Dept. HP-84, Spencer Heater, Lycoming Division, AVCO Manufacturing Corp., Williamsport, Pa.





investigate this modern development in automatically controlled heating!

Send for your copy of this new 16 page bulletin—an interesting and easy to read description of Selectotherm advantages with engineering data.

To the architect and engineer an Illinois Selectotherm System with single dial control means lasting client satisfaction—to the heating contractor, simplicity and ease of installation—to the owner a sound investment that will pay big dividends in comfort, convenience and fuel economy.

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DIVISION OF AMERICAN AIR FILTER COMPANY, INC.

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Illinois Engineering Company
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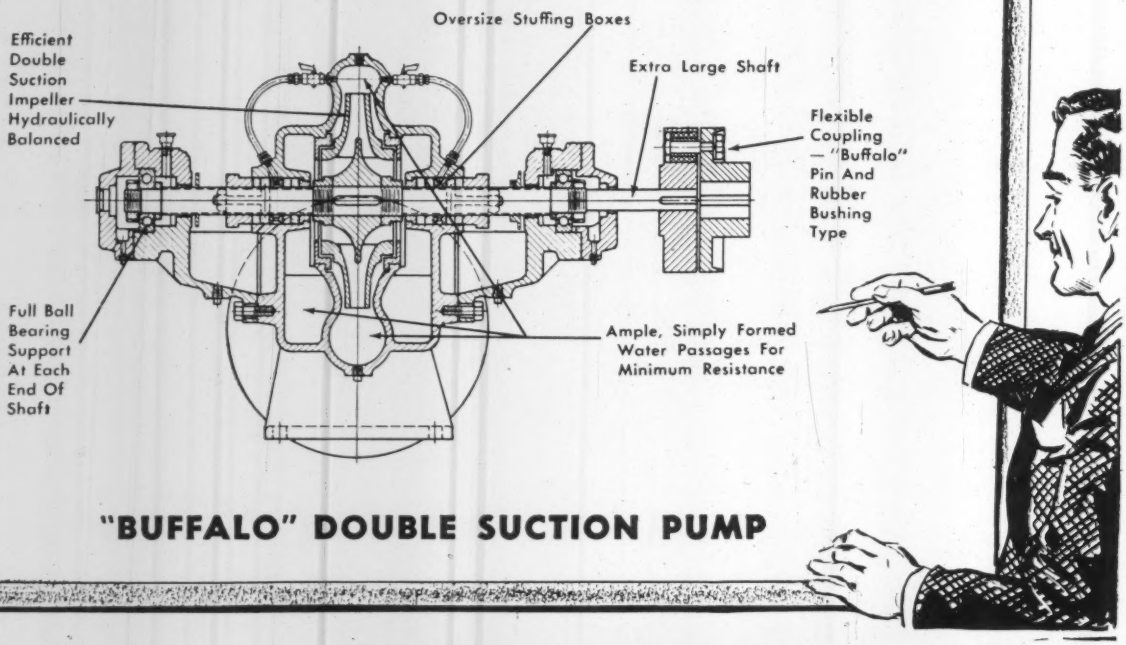
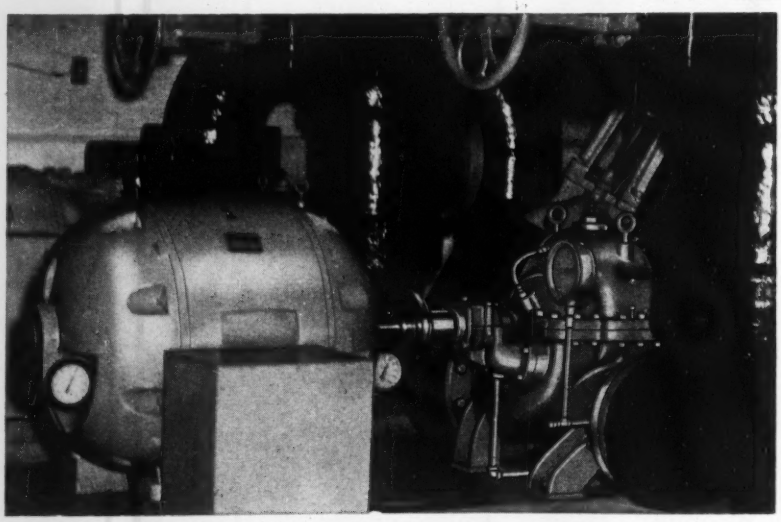
Designed To Make Your Pumping Dollar Go Further!


Efficient Double Suction Impeller Hydraulically Balanced
Oversize Stuffing Boxes
Extra Large Shaft
Flexible Coupling — "Buffalo" Pin And Rubber Bushing Type
Full Ball Bearing Support At Each End Of Shaft
Ample, Simply Formed Water Passages For Minimum Resistance

"BUFFALO" DOUBLE SUCTION PUMP

Whether you need high-volume pumping of chilled water, water for air washing or any other clear water application, you'll find that the excellence of design in "Buffalo" Full Ball Bearing Double-Suction Pumps pays you in long life, quiet operation, high efficiency, reliability and freedom from frequent shutdowns for repairs. It goes without saying that this is the cheapest kind of pumping service. Bulletin 955-P describes these popular pumps in detail. Write for your copy today!



"Buffalo" Double Suction Pumps Handling Chilled Water in a Large Printing Plant.

"Buffalo" PUMPS

BUFFALO PUMPS, INC.

171 MORTIMER ST. BUFFALO, N.Y.

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

TF

They don't come too big for TAYLOR FORGE

As pioneers in the making of heavy-walled large-diameter pipe, it is not surprising that Taylor Forge has developed the widest range of large welding fittings and flanges like those illustrated here.

In fact, those who know the background of Taylor Forge insist on the WeldELL® line for all requirements from smallest to largest. They have found that WeldELLS have features which are combined in no other fittings for pipe welding.

See your Taylor Forge Distributor for up-to-the-minute facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • General Offices and Works: P.O. Box 485, Chicago 90, Illinois • *Offices in all principal cities*
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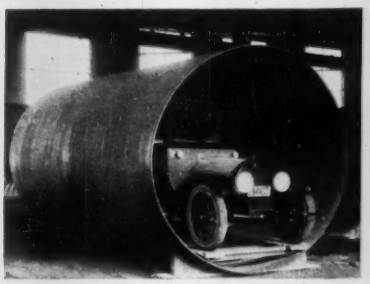


The pipe was farther along than the auto!

They made their automobiles high in the days when this photo was taken at the old Taylor Forge Works, and that's why Taylor Forge chose this way of demonstrating the largest heavy-walled pipe the world of 1916 had ever known.

As a matter of fact, the pipe was farther along than the automobile; for Taylor Forge had started the manufacture of this large pipe as early as 1907. Before then, pipe had been just a tube for conveying fluids, but by 1907 there was a widespread call for large, rated pipe to withstand widely varied and exacting services.

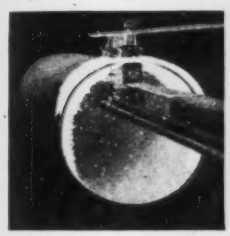
Taylor Forge responded to this call. In pioneering forged steel flanges, Taylor Forge had learned a lot about forging technique and piping practice...and both schoolings were prerequisite to the new venture. The projected large diameter pipe was to consist of heavy plate rolled into shape, then hammer lap welded to a smooth, sound weld. This called for heavy, specially designed equipment to make the process work and to provide the first *smooth interior* pipe and pressure vessel cylinders produced in this country.

Typical of the pioneering obstacles was the need for a clean flame to prevent scale forming at the weld, but this problem was solved when Mr. J. Hall Taylor designed and installed a large water gas plant that provided the desired welding conditions.

Thus it was that by 1916 Taylor Forge was making pipe up to 96"; forging all types of end joints on it; engineering it and prefabricating it into hydro-electric penstocks; laterals and Y's for pumping stations; pipe lines, and for similar applications all over the world.

Since the introduction of automatic metallic arc-welding this large pipe has been produced as "Taylor Straight Seam Electric-Weld Pipe," but there are hundreds of miles of the old "Taylor Hammer Lap Welded Pipe" still giving as good service as it did the day it was installed.

An episode in the story of Taylor Forge leadership in designed piping



This old painting—the original in full color—depicted the original process of making Taylor hammer lap welded pipe.

HEATING PUMPS

To always meet

ALL REQUIREMENTS

CHICAGO INDUSTRIAL PUMPS

Chicago's complete line of heating pumps are designed to meet the specific and exacting needs of building service. When you specify Chicago Heating Pumps you can be certain you will always get the correct pump for the job.

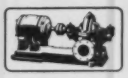
You can get the complete data on any or all series of Chicago Heating Pumps simply by writing for the technical Bulletin referred to under each type. This information is truly complete—includes engineering, specification and dimension data, as well as performance records, charts and tables.

CHICAGO PUMP COMPANY

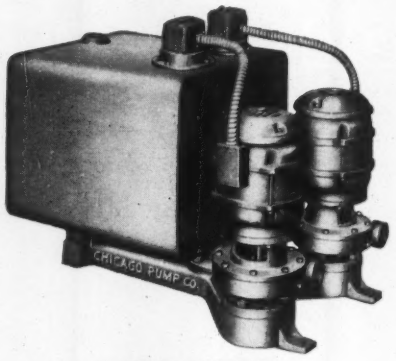
BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY — **CHICAGO 14, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.



Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

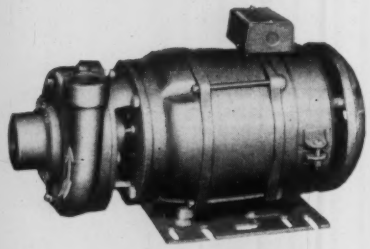


SURE RETURN CONDENSATION PUMP & RECEIVER

For systems up to 75,000 EDR and for low and medium pressures. Available in either single or duplex units. The base serves as a large capacity manifold through which the condensate flows by gravity from the receiver to the pump. The Sure Return will not steam bind. Described in Bulletin 250.

TYPE CLLI VERTICAL CONDENSATION PUMP & RECEIVER

Specifically designed for low return service and underground installations. Flanges are accurately finished and gasketed to prevent steam leaks. Pump and receiver are shipped as a unit, ready to install. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Described in Bulletin 255.

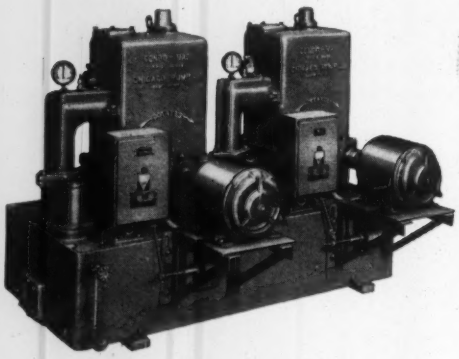


C-C CLOSE-COUPLED SERIES PUMPS

C-C Series Pumps combine pump and motor in a single compact unit for easy installation, eliminating coupling and alignment problems, and are equipped with the leak-proof CHICAGO mechanical seal. Each pump operates over the entire range of its curve without motor over-load.

DUPLEX CONDO-VAC RETURN LINE VACUUM AND BOILER FEED PUMP

Specifically designed for vacuum heating systems. The water capacity of the Condo-Vac remains constant up to the boiling point. The air capacity remains constant to the evaporation point. Pressures up to 40 lbs. Capacities from 2500 to 150,000 EDR. Described in Bulletin 270.



TYPE AVC CONDENSATION PUMP & RECEIVER

Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Sets on floor—no foundation bolts necessary. Weight of unit and piping hold unit firmly in place. For 500 to 10,000 EDR and 10 to 30 lbs. pressure. See Bulletin 245.

UNARCO Convector-Radiator

- Fitted front panel • Easy to clean • Knock-out end panels for easy installation • Cast bronze headers for added heat transmission
- 18-gauge steel front and top • Directional die-formed louvers
- Simple damper control • Carefully rounded corners for safety
- Attractive modern design
- Ideal for homes, offices, institutions, industrial and commercial uses

weather conditioning*

UNARCO

PRICED TO SELL . . . WORLD'S FINEST HEATING AND COOLING PRODUCTS IN A COMPLETE RANGE OF TYPES AND SIZES

*Trademark

Whether your needs are for heating, cooling, or combination self-contained heating-and-cooling units for year 'round service, see how much more UNARCO offers in quality, economy, and efficient performance.

Before you buy, get the UNARCO facts . . . 53 sales offices to serve your needs.

UNION ASBESTOS AND RUBBER COMPANY

HEATING AND COOLING DIVISION • 332 S. Michigan Ave. • Chicago 4, Illinois

Now- SUPER-CLEAN AIR For the Smaller Commercial Installations!

ELECTRO-KLEAN—a compact, high efficiency electronic filter, complete with power pack, which lends itself to a wide variety of small commercial air cleaning operations.

ELECTRO-KLEAN, with access panel removed, showing arrangement of disposable unit-type filter cells containing a special pleated glass media.

AAF Electro-Klean Dry-Type Electronic Air Filter Designed for Unit or Zone Air Conditioning and Packaged Air Handling Units

Small size is no longer a limiting factor in the use of electronic air filters. Beauty shops, drug stores, specialty shops, office suites—all can now enjoy the full benefits of super-clean air. And, whether it's unit or zone type air conditioning (1½ to 25 tons capacity) or a packaged air handling unit, there's an Electro-Klean electronic filter of the right capacity for the system.

Electro-Klean is designed for easy installation and trouble-free operation. In hermetically sealed power pack, vacuum tubes are replaced by selenium rectifier. Having no ionizer, the problem of broken ionizer wires is eliminated. Because Electro-Klean is a dry-type precipitator, no water or sewer connections are needed; no oil is required to retain the precipitated dust. Maintenance, by unskilled labor, is reduced to the simple, periodic replacement of the filter cells which returns filter to its original condition.

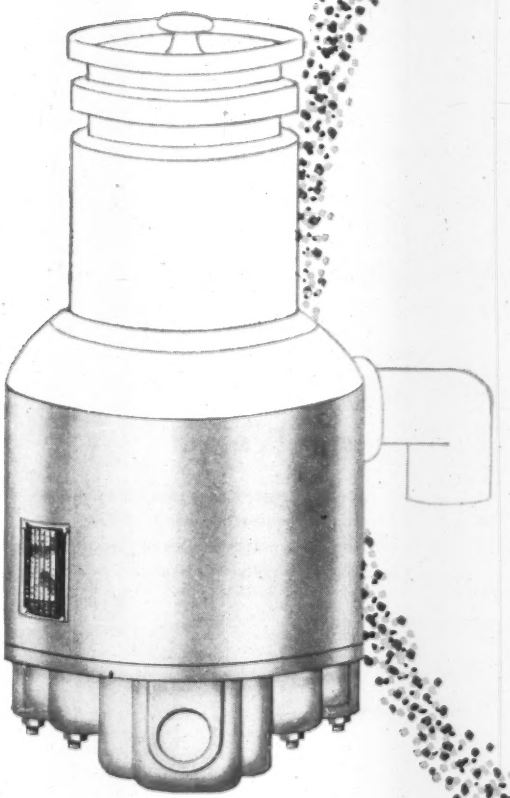
Electro-Klean is available in increments of 300 cfm—which means no job is too small for super-clean air. For complete product information, call your local American Air Filter representative or write direct.

AAF

American Air Filter

COMPANY, INC.

American Air Filter of Canada, Ltd., Montreal, P. Q. • 373 Central Avenue, Louisville 8, Kentucky



it eats up waste!

Food waste and waste motion . . . a modern kitchen disposer eliminates both quickly, permanently.

Today's homemaker never leaves her kitchen sink as she takes care of what used to be an unpleasant chore. *In Many of America's best-known food waste disposers an Emerson-Electric motor does this work for her.*

Emerson-Electric specializes in building motors for products that eliminate waste motion, that perform efficiently for the home, on the farm, in business and industry. It has done so for 64 years, and offers standard motors in ratings from 1/20 to 5 h.p., and hermetic motors 1/8 to 20 h.p. Your inquiry is invited.

THE EMERSON ELECTRIC MFG. CO.
St. Louis 21, Mo.

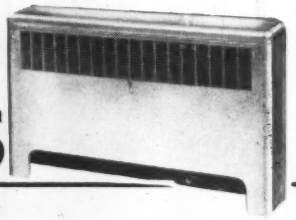
Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M429-A Capacitor-Start
- ☐ M429-B Split-Phase
- ☐ M429-C Integral
- ☐ M429-D Fan-Duty
- ☐ M429-E Oil-Burner
- ☐ M429-F Jet Pump
- ☐ M429-G Blower

EMERSON ELECTRIC
MOTORS • FANS — APPLIANCES

6600 Airtherm CONVECTORS



Add Beauty and Comfort to the . . .

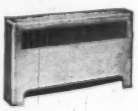
. . . 1736-Unit PRUITT Housing Project

The clean, uncluttered design of Airtherm Convectors blends perfectly with the modern decor of the new Wendell Oliver Pruitt Homes in St. Louis. Their outstanding performance, ease of installation and easy maintenance make them exceptionally practical for this huge housing project.

Airtherm Convectors, available in wall, recessed or free-standing models, can help you solve a wide range of heating problems. Write for Catalog 702-A or consult our Catalog in Sweets Architectural File 28c Ai.

See our catalog in S or write for copy

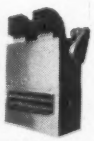
Architect—Hellmuth, Yamasaki & Leinweber, Inc.
Mechanical Engineer—John D. Falvey
General Contractor—Millstone Construction, Inc.
Heating Contractor—Kremer-Hicks Company



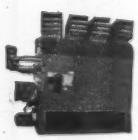
Convectors

Vertical Steam Unit Heaters

Horizontal Steam Unit Heaters



Centrifugal Fan Type Unit Heaters



Direct Fired Space Heaters

Gas Fired Unit Heaters

FOR HEATING SATISFACTION . . . THINK FIRST OF

Airtherm MANUFACTURING COMPANY

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the best running mate your product can have–

DELCO MOTORS

With exceptionally long life and outstanding quality built in . . . with worldwide recognition and acceptance—a Delco motor adds a unique plus value to any product it serves.

Delco fractional and integral motors are readily available in a wide range of sizes to assure you of the best running mate *your* product can have.

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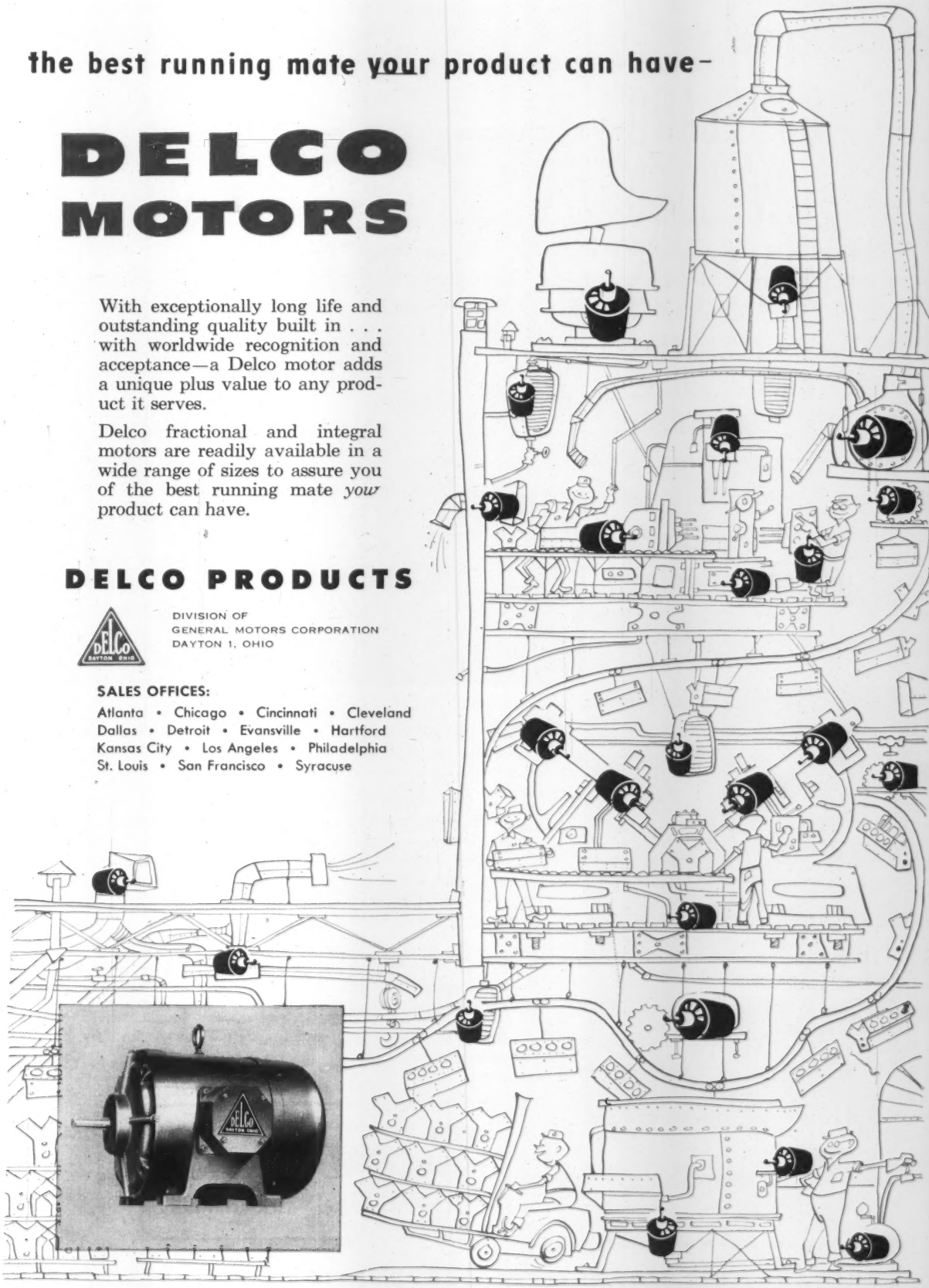
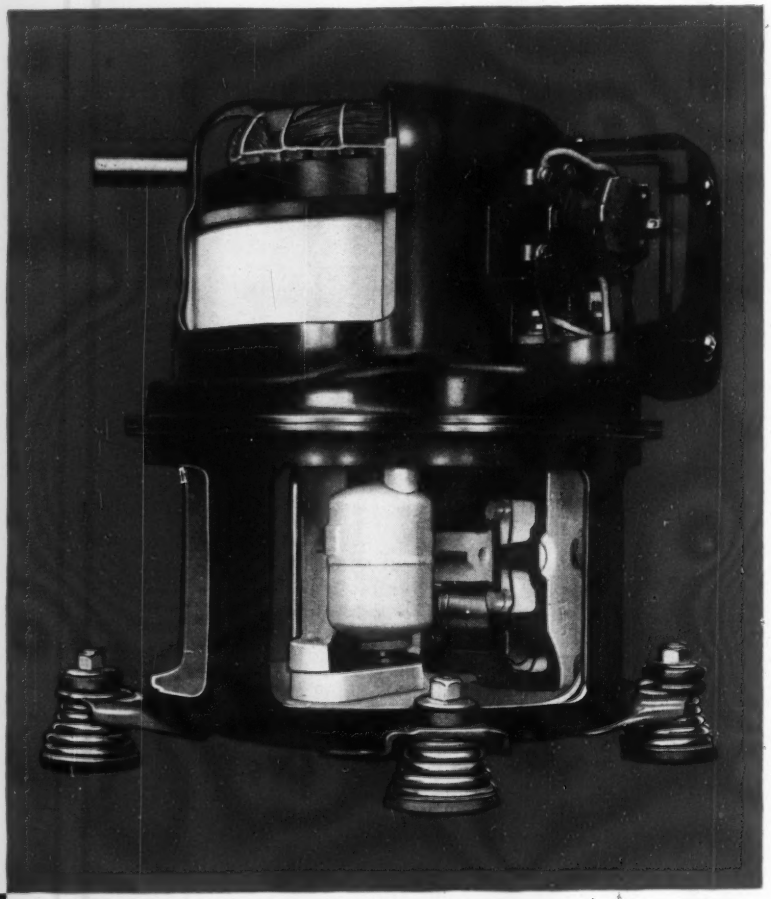
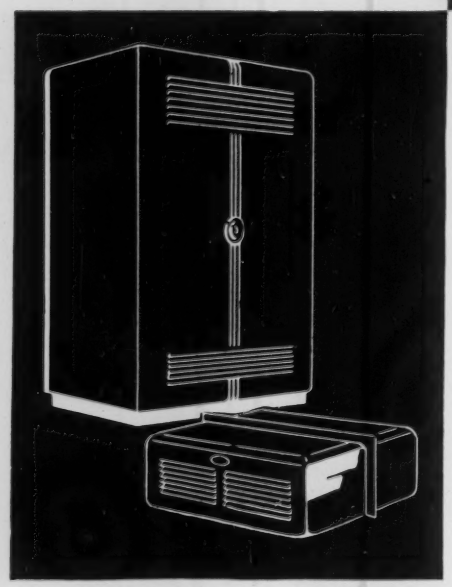


COPELAND WELDED HERMETICS

bring cool-running, 2-cylinder smoothness to package air conditioning



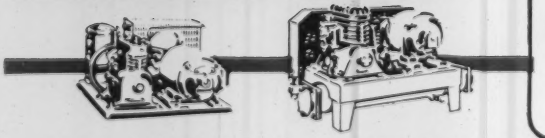


You're looking at a cutaway view of the welded motor-compressor that can give your refrigeration and air conditioning products the competitive edge you need.

This potent Copeland package is engineering at its best. Twin cylinders bring whisper-quiet smoothness. Heavy-duty, high power factor motor insures positive performance and long-range economy. Use of F-12 in these motor-compressors can result in as much as 75 F. lower temperatures in windings, crankcase, oil and discharge side. You'll appreciate their high capacities.

We could go on, point by point, and prove construction superiority. Better yet, we want you to test the Copeland welded motor-compressor in your own equipment under your own conditions.

Write, wire or phone for details about the "try it yourself" test.



REFRIGERATION UNITS (OPEN-TYPE AND COPELAMETIC) WATER COOLERS

Copeland
DEPENDABLE *Electric* REFRIGERATION

COPELAND REFRIGERATION CORPORATION SIDNEY, OHIO

Random Thoughts from a Filter Engineer

by Richard E. Brown

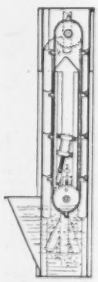
- **ENGINEERS DO HAVE IMAGINATION!**
- **HOW TO EVALUATE FILTER "TESTS" OR PROOF POSITIVE OF WHAT?**
- **WHY THE HIGHEST EFFICIENCY FILTER ISN'T ALWAYS THE BEST**

ENGINEERS DO HAVE IMAGINATION!

It's fashionable these days to accuse us engineers of not being able to see beyond our slip sticks. We're supposed to be great when it comes to exact calculations but not much when imagination is needed. Don't believe it. Engineers, like writers, are often inspired to real creation. Call it a creative hunch, if you like, but it definitely exists.

For instance, we're proud of a bit of inspiration one member of our engineering department came up with. The idea of a self-cleaning, curtain type filter is not new. But the idea behind Air-Maze's new cleaning action—called "pulse-type" action—*is* new.

All self-cleaning filters submerge each panel of the revolving curtain in a cleaning tank at the bottom. But Automaze, (below right), Air-Maze's new self-cleaning filter, goes a step further. It vigorously agitates each panel 6 or more times in the oil bath, gets it *really* clean.

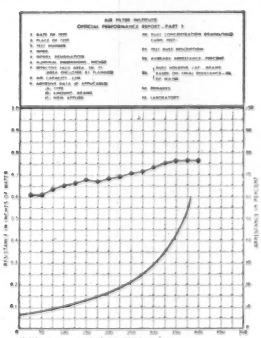


Automaze

The problem was to find a way of forcefully moving each panel back and forth in the oil bath so that it would be thoroughly cleaned. The solution: a compressed air drive that gives exactly the quick, forceful motion required. It's an Air-Maze exclusive. And a good example, we think, of the kind of imagination that filter users have come to expect from Air-Maze.

HOW TO EVALUATE FILTER "TESTS" OR PROOF POSITIVE OF WHAT?

You've probably seen the results of a good many filter tests. There's hardly a filter manufacturer who would be caught dead without a briefcaseful. And each company is setting out to prove with tests that "our" filter will trap more dust than the next fellow's.



Typical Standardized AFI Test Form

If you try *comparing* these test results you may wind up a little dizzy from the effort because hardly any two manufacturers run tests under identical conditions. It's something like comparing apples and oranges. Particularly since many different types of test dust are used.

You may have wondered, as we have, why all the manufacturers of "mechanical" type filters don't use the same test procedure. Here at Air-Maze, we've installed the equipment designed by the Air Filter Institute and use the A. F. I. standardized test dust for all filters except our electrostatic precipitators (which we test with the National Bureau of Standards Discoloration Method, using atmospheric dust). It's our hope that more of the other filter companies will follow suit—to make your job easier when specifying filters.

Tests serve a useful purpose in filter design and Air-Maze makes plenty of them. In the final analysis, though, there are only two things that really determine a filter's value. One is the reputation of the makers. The other, and most important, is the experience of users over a long period of time.

WHY THE HIGHEST EFFICIENCY FILTER ISN'T ALWAYS THE BEST

It's no problem at all to build a filter that's efficient enough to stop almost all air-borne particles. But usually, as you add efficiency, you have to cut dirt-holding capacity, or increase air-resistance or raise costs.

The ideal filter is the one that has the right combination of advantages to solve a particular filtering problem—not necessarily the one with the highest efficiency.

It's like buying a car on gasoline mileage alone. You'll probably have to sacrifice roomy interiors, high horsepower, roadability, or other things you want. The question will be to decide what combination of advantages best suits your needs.

Electromaze

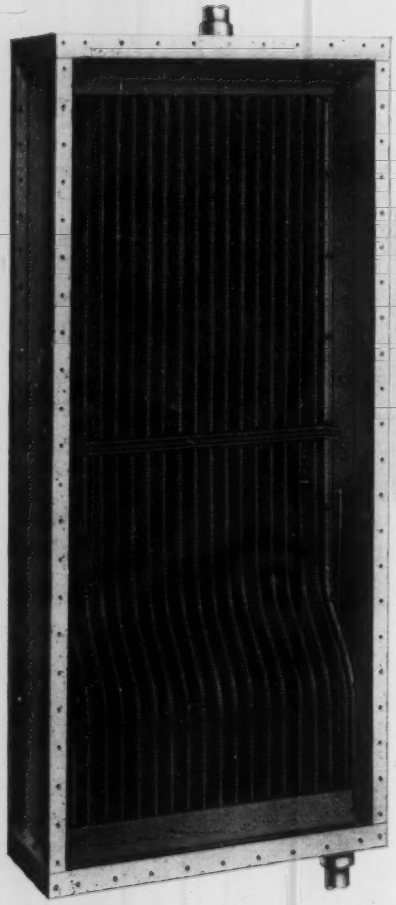
It may not take an expert to help you pick the right car. But we think you'll do better to call on expert advice the next time you buy filters. We at Air-Maze have 29 years experience in giving people what they want in a filter. If it's high efficiency you want, we offer the Electromaze (above) which traps particles as small as 1/250,000 of an inch! Yet we are happy to sell you the inexpensive Kleenflo filter if it will do the job. So call on us if you have a filter problem. There's no obligation. Air-Maze Corporation, Cleveland 28, Ohio. In Canada, Masdom Corp., Montreal and Toronto, Fleck Bros., Vancouver.

AIR-MAZE

The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS
LIQUID FILTERS • OIL SEPARATORS • GREASE FILTERS

EFFICIENT *Extended-Surface* HEAT EXCHANGERS



for

Heating
Cooling
Process
Air Conditioning

ASK THE AEROFIN MAN

Your Aerofin man's recommendation means high efficiency, long service life, low maintenance costs.

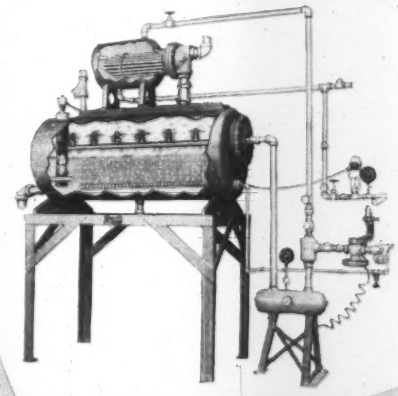
Aerofin's unequalled laboratory and manufacturing facilities — unequalled knowledge of heat-exchange practice — are devoted exclusively to the design and manufacture of highest quality extended heat surface.

Aerofin is sold only by manufacturers of fan-system apparatus. List on request.

AEROFIN CORPORATION
101 Greenway Avenue, Syracuse 1, N. Y.

a *Fresh* approach . . . a *Major* advance . . .

in boiler feedwater deaeration



SCHAUB
ZERO-OXYGEN
Deaerators

NEW DESIGN! NEW PERFORMANCE! NEW SAVINGS!

Complete Oxygen Removal (to .005 cc/liter) • Complete Safety and Dependability • Wide Range for Load Variations • High Thermal Economy • Low Maintenance Costs • Simpler Design for Trouble-Free Service

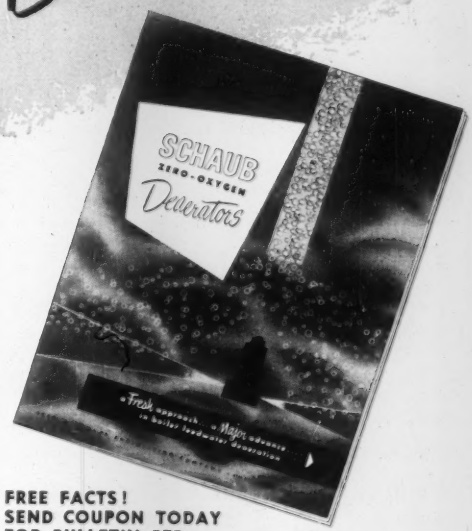
Start with an idea that's *basically* new and better. Then produce performance beyond the best that ordinary deaerators can deliver. Schaub engineers achieved it . . . developed the all-new deaerator that's a major advance in boiler feedwater deaeration!

Two basic differences give the Schaub Zero-Oxygen Deaerator its outstanding advantages . . . note them well. First, it provides *external* pre-heating to a temperature *above* boiling point, with over-atmospheric pressure held only up to the internal sprayer manifold! Second, a free, non-restricted vent liberates *all* air *immediately* with maximum vapor heat recovery!

From these simple fundamentals stems a whole series of all-important performance benefits. Every engineer or operating man concerned with boiler feedwater deaeration should have the full facts on all-new Schaub Zero-Oxygen Deaerators. Simply send the coupon to get the complete story — promptly.

FRED H. SCHAUB ENGINEERING COMPANY

2116 South Marshall Boulevard • Chicago 23, Illinois



FREE FACTS!
SEND COUPON TODAY
FOR BULLETIN 575

Tells why you need deaeration. Explains basic differences in deaeration systems. Here's the complete story on new Schaub Zero-Oxygen Deaerators.

FRED H. SCHAUB ENGINEERING COMPANY
2116 South Marshall Boulevard, Chicago 23, Illinois

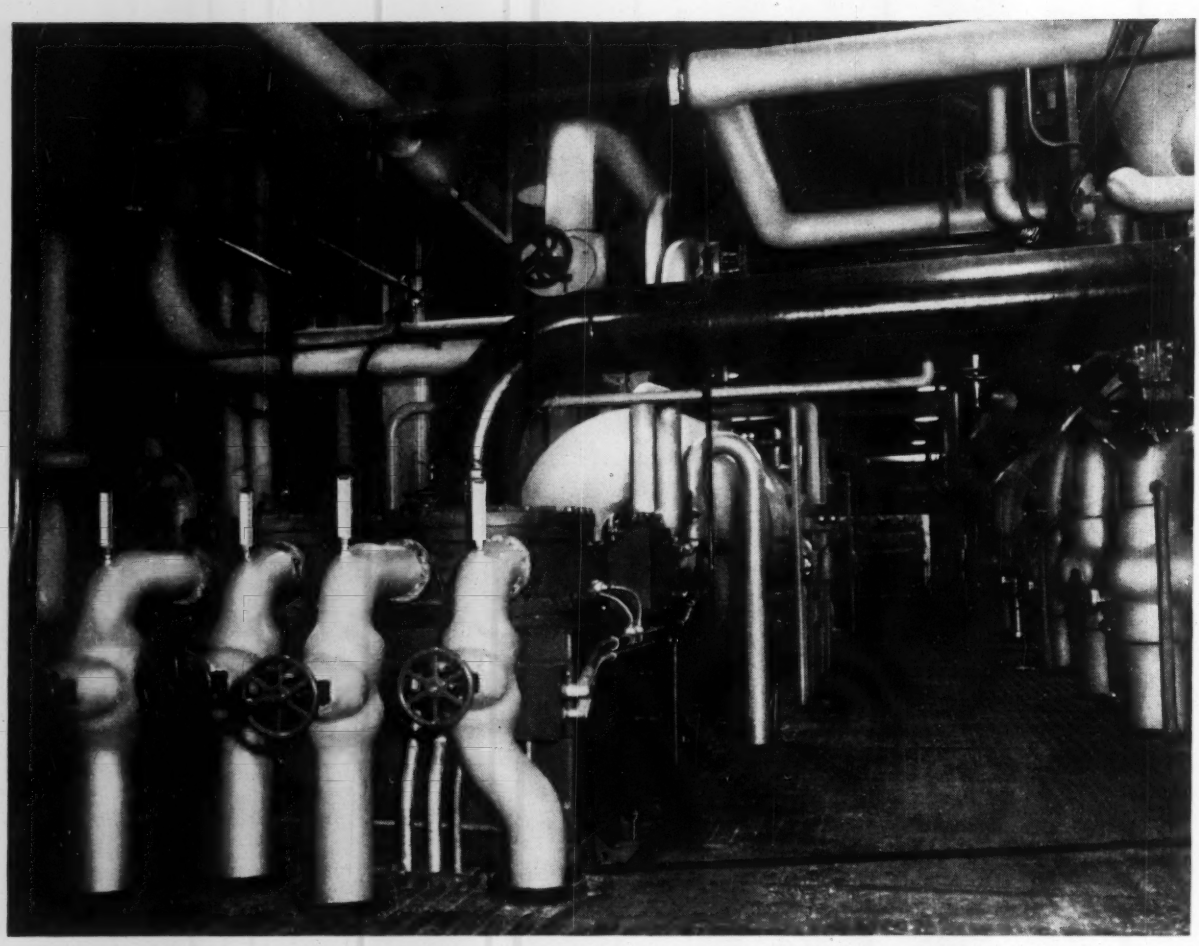
Please send me without cost or obligation, my personal copy of your new bulletin 575 on Boiler Feedwater Deaeration.

NAME_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____



Main steam line and feeder equipment of a large southern power station insulated with a combination of K&M Hy-Temp and "Featherweight" 85% Magnesia.

Dollar and heat loss minimized by power stations with

K&M HIGH TEMPERATURE INSULATIONS

For efficient, money-saving conservation of heat, keep in mind dependable K&M High Temperature Insulations. For example, by itself, "Featherweight" 85% Magnesia (85% basic carbonate of magnesia and asbestos fiber) effectively insulates piping and equipment with temperatures up to 600° F. Used with a primary layer of K&M Hy-Temp Insulation (diatomaceous silica), the combination is effective on applications up to 1900° F.

These K&M insulations last the life of the equipment they serve. They withstand moisture, vibration and frequent temperature changes.

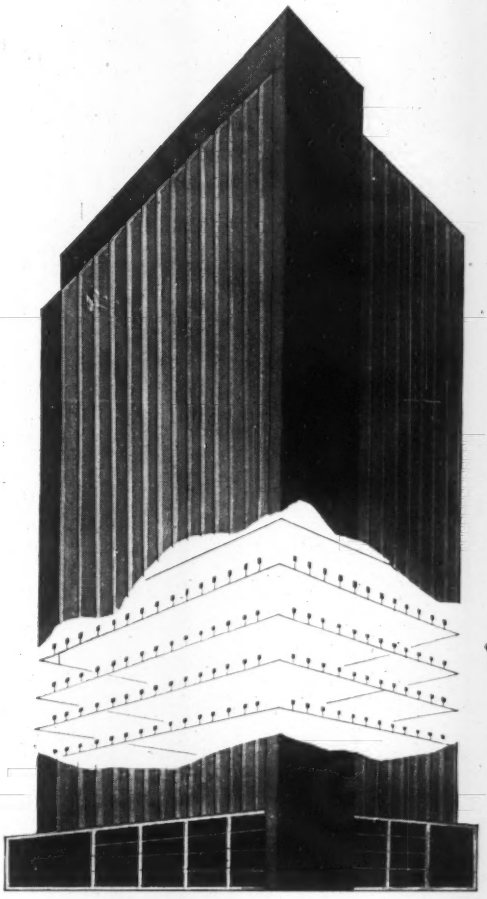
New and now available is "Featherweight" Water-Resistant Magnesia Insulation for temperatures up to 450° F. It is for use where severe water exposure may damage the insulation or on indoor lines and equipment where high humidity and moisture is necessary.

Your K&M distributor is an experienced applicator who will gladly give you more information on these heat-saving, money-saving K&M insulations. Or write directly to us.

KEASBEY & MATTISON COMPANY • AMBLER • PENNSYLVANIA

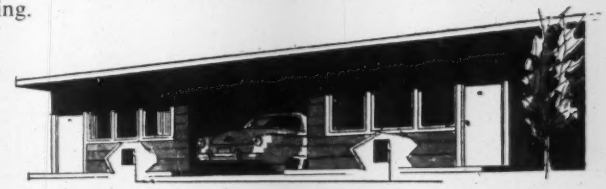
Nature made asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

K&M best in asbestos ®



Modulated Heat with Thermostat in Every Room

Every room in a building is an individual zone, with its own thermostat. Every room is heated with filtered warm air, continuously circulated by a compact, recessed wall unit. Sets a new standard of comfort and heating economy for every type and size of residential, institutional and commercial building.



SelecTemp Highlights

THERMOSTAT IN EACH ROOM. Temperatures can be varied in every room to fit the "activity plan" and personal preference of the occupants.

MODULATED HEAT. Air circulation is continuous. Both temperature and volume of air is automatically modulated, as required to offset heat loss from room.

FILTERED, CIRCULATED AIR. Individual room air circulation prevents transmission of odors or bacteria from other rooms. Air is cleaned by a spun glass filter in each room unit. Filtered outside air can be introduced if desired.

BOILER LOCATION. Does not require centrally located heating plant. Boiler can be placed in any desired location, with proper distribution of heat to every room.

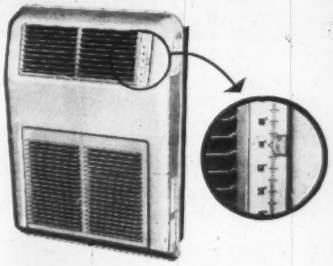
LOW POWER COST. No electricity required to operate circulating fans. Nonelectric thermostats.

LOW INITIAL COST. No other system can be so easily installed in either new or old construction. Small soft copper tubing (¾ inch I.D.) carries steam to individual room heater units. Return lines are ⅝ inch. Tremendous savings in installation costs.

LOW FUEL COST. Temperature easily reduced in unused rooms. Eliminates overheating.

AUTOMATICALLY BALANCED. No special adjustments of dampers, valves or orifices required to balance heating system. Each unit continuously regulates heat needed for each room. Automatically compensates for external heat sources such as fireplace or solar heat, without affecting temperatures of other rooms.

FOR LARGE OR SMALL BUILDINGS



Individual room control with continuous modulated heat

With SelecTemp heating, every room in the building is an *individual zone*, with its own thermostat. Low pressure steam, supplied to recessed wall units through small flexible copper tubing, provides heat and power for the circulating fan. Thermostats are nonelectric and require no wiring.

Exact, constant temperatures

Each room thermostat may be set at any temperature from 40 to 90 degrees. Heat in each room is accurately maintained at the temperature selected. The thermostat detects any change in temperature and regulates both the speed of the circulating fan and the steam supply to exactly meet heating requirements. SelecTemp thus eliminates ordinary on-and-off cycling and "cold 70" stratification. It constantly modulates from 1/20th of capacity to full capacity, supplying just the amount of heat needed. SelecTemp compensates automatically for variations due to changes in outdoor temperature, and in velocity and direction of the wind. It compensates for heat gains from the sun's heat, fireplaces, cooking ovens and body radiation.

Low installation and operating cost

The various parts of the selecTemp system are engineered for rapid economical installation without time wasting special provisions. SelecTemp units are delivered assembled in steel enclosures for mounting in wall stud spaces or wall openings. No electric power required for operation of circulating fans or thermostats—an important saving. Fuel savings result from elimination of wasteful overheating and from lower temperatures in unoccupied rooms. Small steam lines greatly reduce heat transmission losses.

SelecTemp
TRADE MARK
PRODUCT OF IRON FIREMAN

Send for full information

IRON FIREMAN MANUFACTURING CO.
3070 W. 106th Street, Cleveland 11, Ohio.

Please send literature on Iron Fireman SelecTemp heating.

Name _____

Address _____

City _____ State _____

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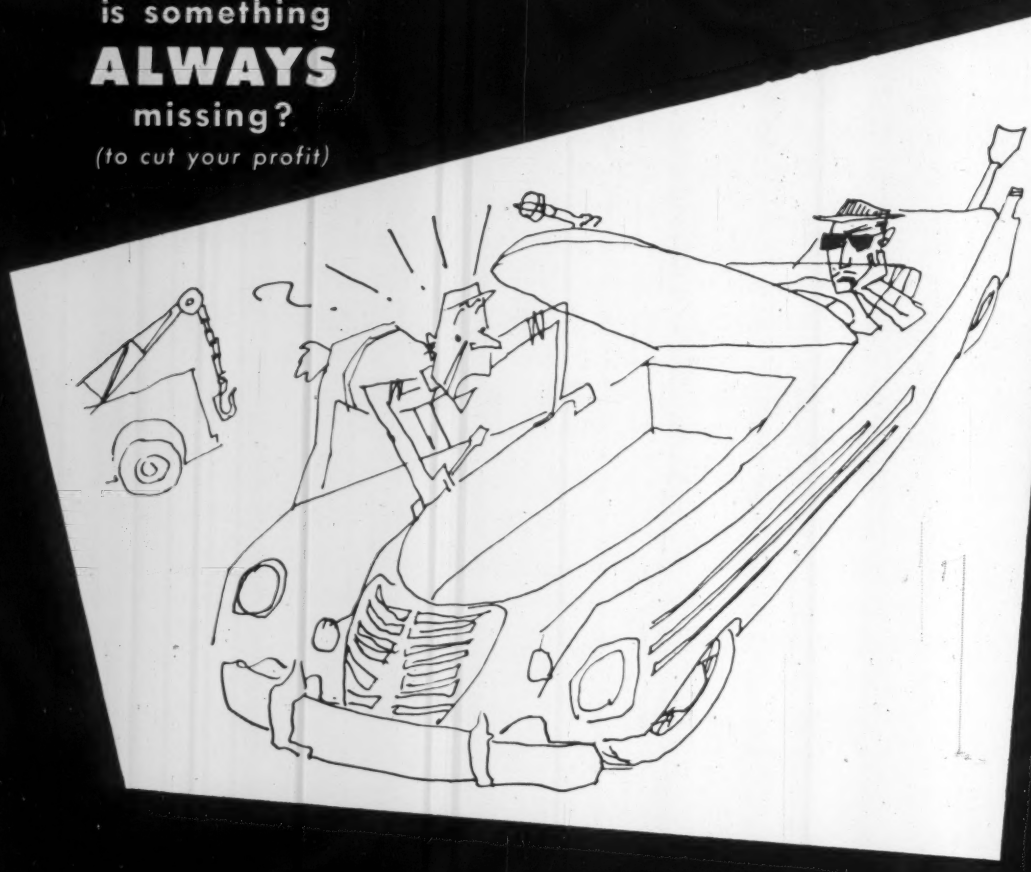
I. F. Mfg. Co.

is something
ALWAYS
missing?
(to cut your profit)



...then switch to the one line that meets every selling need

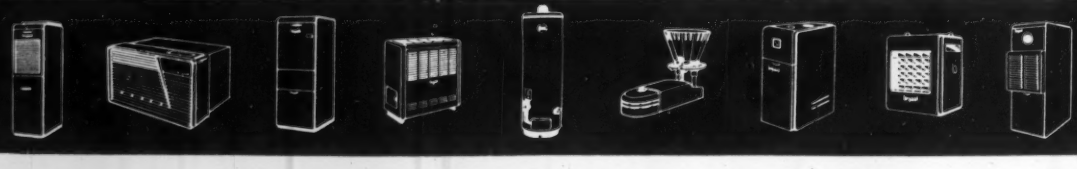
* **EXAMPLE No. 6:** It's easy to improve your profit performance with an aggressive line-up of factory experts behind you. Bryant's field representation puts the services of *all* these men at your disposal: a division sales manager; a district sales representative; and a traveling, three-man, sales-training and service team consisting of a heating product specialist; an air conditioning specialist, and a merchandising specialist. You can avail yourself of *all* these profit-building services by switching to Bryant, *now!*

Your Bryant Distributor has full details.

bryant®
HEATING AIR CONDITIONING WATER HEATING

1. The most complete line in the industry
2. Quality products—Competitively priced
3. Established name—Good customer acceptance
4. Broad, attractive profit margins
5. Local Distributor warehousing and service
* 6. Factory district representatives and traveling sales training and service teams

Bryant Heater Div., Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10, Ohio



GIVE EVERY JOB *The Quality Touch* OF CHASE COPPER

Copper adds extra value to any home!

Use Chase Copper Tube in your next radiant heating installation, and you'll do a *quality* job better... and *faster*.

Because Chase Copper Tube comes in compact coils, it's easier to handle, saves you time. And since Chase Copper Tube comes in *long length* coils, you reduce the number of joints, save the cost of many fittings.

And the joints you *do* make with Chase Copper Tube fittings are leak-proof and strong as the tube itself!

A radiant heating installation of Chase Copper Tube and solder-joint fittings is pressure-tight for *good*... it's a job you can be proud of!

Ask your Wholesaler for Chase Copper Tube and Fittings.

Chase

BRASS & COPPER CO.

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany†	Chicago	Denver†	Kansas City, Mo.	Newark	Pittsburgh	San Francisco
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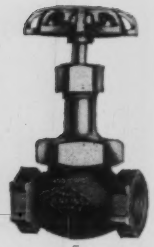
Baltimore	Cleveland	Houston	Milwaukee	New York	Rochester†	Waterbury
Boston	Dallas	Indianapolis	Minneapolis	Philadelphia	St. Louis	(†sales office only)



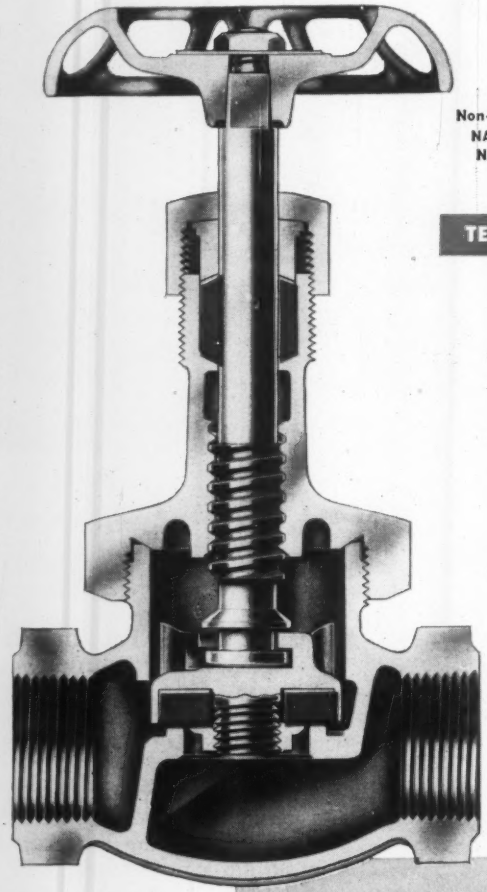
This "Hospital Valve" for OXYGEN now serves many industrial needs . . .

JENKINS Fig. 504 Bronze Globe with TEFLON disc and packing

Jenkins Fig. 504 was designed for the critical requirements of controlling oxygen, nitrous oxide, or any non-flammable gases in hospital services. Industry was quick to note its unique advantages, and it is now frequently specified for systems carrying gaseous fluids for heating, cooling, lighting, and processing, where pressure does not exceed 400 psi, or temperature a maximum of 150° F.

Fitted and tested to comply fully with all Association specifications for hospital services, Fig. 504 has the "extra value" construction throughout that is assured by Jenkins quality standards.

Get details — find out how Fig. 504 can improve efficiency and economy in your hookups for critical service. It's another example of the broad range of "valves for every service" in Jenkins' complete line.



Complies fully with "Standards for Non-Flammable Medical Gas Systems" of—
NATIONAL FIRE PROTECTION ASSOCIATION
NATIONAL BOARD OF FIRE UNDERWRITERS
AMERICAN HOSPITAL ASSOCIATION

TEFLON Disc and Packing

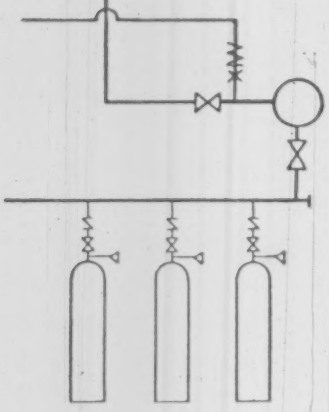
DuPont "Teflon" is a tough, "waxy" inert solid, gray-white in color, tasteless and odorless, non-adhesive and frictionless. Teflon's high resilience assures perfect contact of disc with lapped, crowned seat for gastight closure. Packing is one-piece ring of Teflon, provides dependable leak-proof seal with light compression.

Reinforced Body Casting
High strength bronze body is ribbed along bottom centerline providing extremely high factor of safety. Guards against distortion from vibration, shock, or pipe strains.

Degreased
All bronze parts are thoroughly degreased before assembly.

Polished Spindle
Alloy bronze spindle is polished to permit easy turning and assure leak-proof seal.

Sizes
— ¼" to 2" — 400 lb. O.W.G.



GET COMPLETE INFORMATION from your Jenkins Valve Distributor, or write: Jenkins Bros., 100 Park Ave., New York 17. Ask for Bulletin 116.

JENKINS VALVES

LOOK FOR THE JENKINS DIAMOND

SINCE 1864 — TRADE JENKINS MARK

Jenkins Bros

SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS EVERYWHERE

EQUIPMENT DEVELOPMENTS . . .

For reviews of Recent Trade Literature see page 222.

Snap On Pipe Insulation

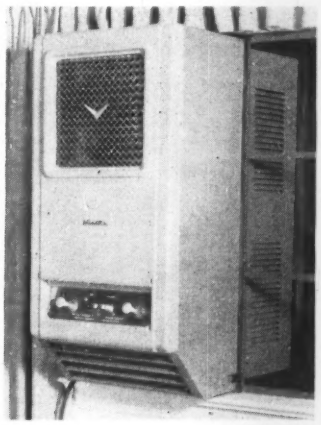
"Snap On" pipe insulation now being manufactured in a new range of sizes from ¾ to 24 in. diameter. . . .The insulation, made of molded fine glass fibers, is suitable for chilled and refrigerated lines and for heated lines where the temperatures do not exceed 350 F. It is available in 3 and 6 ft lengths, depending on pipe size. Wall thicknesses of ½, ¾,

1 and 1½ in. are available in sizes to 12 in. pipe size; and 1, 1½, and 3 in. wall thickness for piping above 12 in. diameter. The insulation is applied by spreading it open at the single seam and snapping it on the pipe. The seam is joined with staples or other conventional means.

Manufacturer—Gustin-Bacon Mfg. Co., 210 W. 10th St., Kansas City, Mo.

Casement Window Conditioner

Three-quarter ton air conditioner for casement windows. . . .A push button control panel provides six selections of weather, and room air is

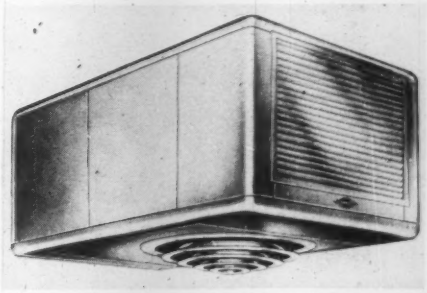


changed five times an hour, according to the manufacturer, Victor Products Corp. Compressor, fan motors and fan blades are cushion mounted for quiet operation. Fixed louvers and grilles are designed to eliminate a great deal of vibration. The unit can be operated on a 115 volt, single phase, 60 cycle circuit. It requires no pipes, drains or water for operation. It is mounted from the inside of the room.

Distributed by—Amstan Supply Div., American Radiator & Standard Sanitary Corp., P.O. Box 1226, Pittsburgh 30.

Ceiling Suspended Air Conditioner

Ceiling suspended air conditioner for industrial or commercial use . . . . A built in winch is designed to enable two men to install the unit in a short time. The winch also permits the entire unit to be lowered so that it can be serviced by one person. Sizes range from 3 to 7½ tons. The company says that no ductwork is required because the unit has a

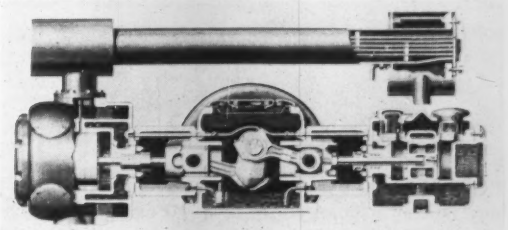


built in circular grille at the bottom, but that it can be adapted for use with ducts. It is equipped with a condensate pump to eliminate the need for drain pipes. The cabinets are heavily insulated to prevent condensation.

Manufacturer—Union Asbestos and Rubber Co., 332 S. Michigan Ave., Chicago.

Packaged Air Compressor

Packaged air compressor in the 75 to 100 hp range. . . .The compressor, known as the "PHE", is an opposed cylinder, balanced design, driv-



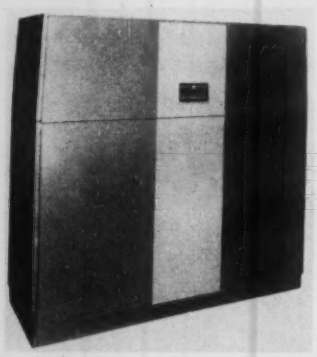
en by a direct connected induction motor. The basic design is a two stage unit for 80-125 psi, but other cylinder arrangements are available. The aluminum

bearings rotate slowly to take the major thrust of each succeeding stroke on a different portion of the shell. Piston and rod assemblies of equal weight moving in opposite directions on a 180 deg crank balance out all primary and secondary inertia forces without the use of counterweights, the manufacturer states. The crossheads are of the aluminum piston type.

Manufacturer—Ingersoll-Rand Co., 11 Broadway, New York 4.

Air Source Heat Pump

Large packaged air source heat pump to supplement the "Weathertron" line . . . . The new unit is powered by two modulated 5 hp compressors and handles up to 3000 cfm, the company states. It features a sealed hermetic refrigeration system.

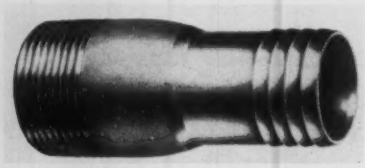


The pumps, using only electricity, extract heat from the indoor air in summer and pump it outside. In winter, the process is reversed automatically, so that heat in the outside air is pumped inside.

Manufacturer—General Electric Co., Air Conditioning Div., 5 Lawrence St., Bloomfield, N.J.

Metal Adapter for Plastic Pipe

Metal adapter for plastic pipe which offers a flat clamping surface and four heavy serrations for protection in connecting plastic pipe . . . . The fittings are available for either male or female pipe connections and are supplied in either galvanized



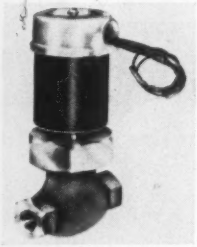
steel or brass. Sizes range from ½ in. through 2 in. There is also a long pattern 6, 8, 10 or 12 in. adapter for connecting plastic pipe directly to a jet assembly and protecting the venturi tube.

Manufacturer—The Capitol Mfg. & Supply Co., 153 W. Fulton St., Columbus 16, Ohio.

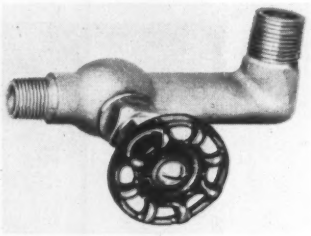
Bottom Outlet Oil Tank Filter Valve

"No. 807" bottom outlet oil tank filter valve . . . . The valve is designed for use on the new bottom outlet tanks. The length of the elbow is long enough to give adequate clearance between the tank and the valve handle when being installed, according to the manufacturer. The valves are available in two sizes—½ in. IPS × ⅜ in. IPS and ¾ in. IPS ×, ⅜ in. IPS. They are equipped with oilproof packing.

Manufacturer—Rockford Brass Works, 700 S. Main, Rockford, Ill.



Solenoid Valve



Filter Valve

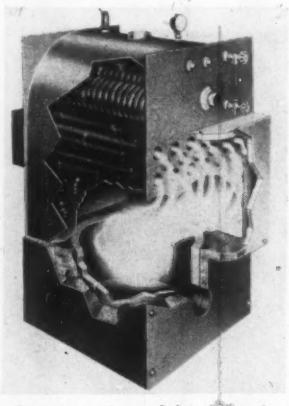
Stainless Steel Solenoid Valve

Solenoid valve of stainless steel for very high pressures offered in ½, ¾ and 1½ in. pipe sizes . . . . The ½ and ¾ in. sizes are rated to 2500 psi and the 1½ in. to 3000 psi. Piston rings compensate for expansion under heat and eliminate sticking. The valves are available for normally open and normally closed operation with a bubble tight pilot valve feature. Explosionproof housings for use in hazardous atmospheres are optional.

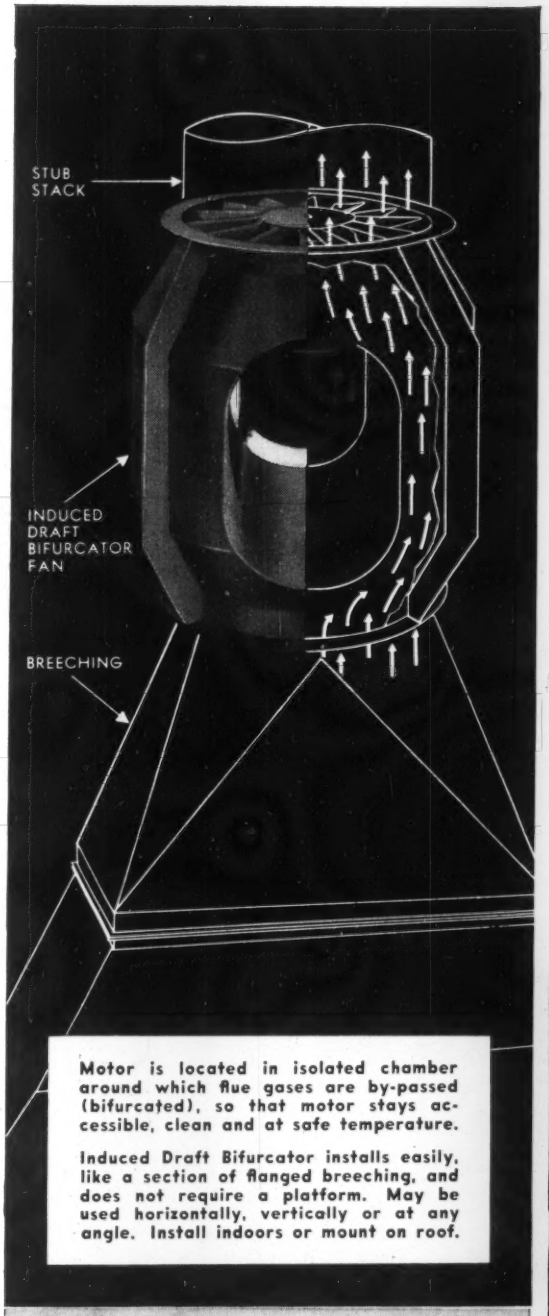
Manufacturer—Atkomatic Valve Co., Dept. S108, 545 Abbott St., Indianapolis 25.

Tankless Volume Water Heaters

Extension of sizes of the "WH Series" of tankless twin coil volume water heaters . . . . Fired with oil or gas, the self contained water heaters



are available in nine sizes delivering hot water from 300 to 5000 gph. The twin copper coils are connected adjacent to each other and submerged horizontally across the top section of the heater. One coil acts



Motor is located in isolated chamber around which flue gases are by-passed (bifurcated), so that motor stays accessible, clean and at safe temperature.

Induced Draft Bifurcator installs easily, like a section of flanged breeching, and does not require a platform. May be used horizontally, vertically or at any angle. Install indoors or mount on roof.

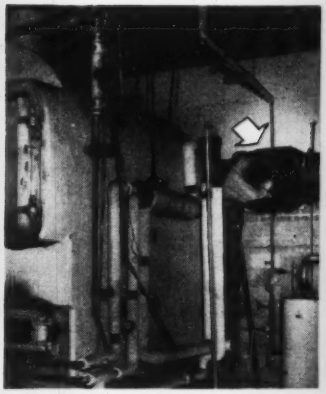
ELIMINATE TALL STACK...SAVE on COST and MAINTENANCE

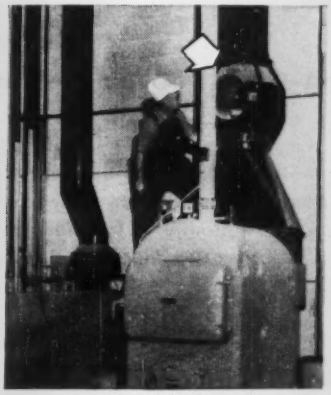
BIFURCATOR FAN

provides controlled boiler draft

The Induced Draft Bifurcator Fan provides controlled draft for boilers and furnaces under all weather conditions, and yet costs only a fraction as much as a tall stack. An Induced Draft Bifurcator Fan also solves the draft problem when you have no room for a tall stack or object to its unsightly appearance.

Bifurcators provide adequate draft for high-pressure boilers delivering up to 60,000 pounds of steam per hour and for low-pressure boilers rated up to 190,000 EDR. For specifications and construction details, use the handy coupon to request free Bulletin DB-32-53.





DeBothezat Fans

Division of

American Machine and Metals, Inc.

EAST MOLINE, ILLINOIS

DeBOTHEZAT FANS, DEPT. HP-854
Division of American Machine and Metals, Inc.
East Moline, Illinois

Please send me free Bulletin DB-32-53 containing data on Induced Draft Bifurcators.

FIRM NAME

STREET ADDRESS

CITY ZONE STATE

ATTENTION OF MR.

as a preheater, permitting hot water circulation through the coils. The twin coils, being completely surrounded by fast circulation hot water, accomplish quick temperature pickup and require no recovery time, the manufacturer states.

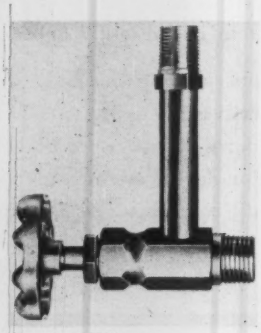
Manufacturer—Portmar Boiler Co., Inc., 193 Seventh St., Brooklyn, 15.

Tank-Filter Hookup Valve

Tank-filter hookup valve for oil fired heating systems . . . . The "No. 1910" valve directly connects the oil filter to the underside oil tank discharge outlet and permits the filter to be placed out beyond the rim of the tank where it can be installed, removed and serviced without interference. It has an adjustable packing nut, metal to metal precision seating and leakproof brazed body connections.

Manufacturer—Guardian Products Corp., Valve Div., 1244 E. Second St., Michigan City, Ind.

Welder


Valve

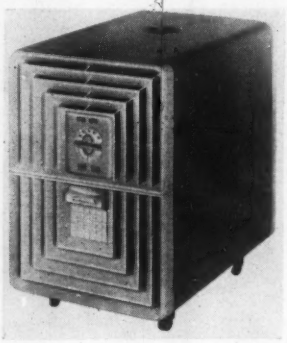
A-C and D-C Arc Welder

"P & H" arc welder for both a-c and d-c welding . . . . The manufacturer states that a flip of the switch gives the desired welding current and that it is possible to change from one current to the other while welding. The machine, which has no moving parts, has an a-c welding service range of from 7 to 275 amp and from 7 to 200 amp for d-c. It operates on 220/440 volt, 50/60 cycle current, single phase. The unit is equipped with a "Dial-lectric" control designed to provide instantaneous heat selection. For remote control, the radio-type dial may be taken to the work.

Manufacturer—Harnischfeger Corp., Welding Div., 4400 W. National Ave., Milwaukee.

Dehumidifier and Heater

Electric dehumidifier that heats as well as dries, incorporating a 1000 watt heating coil and high speed fan . . . . The manufacturer states that the unit removes from 2 to 3 gal of water in 24 hr and will control the moisture content in a closed room of up to 10,000 cu ft. To dehumidify, the unit draws moist air over evaporator coils cooled by circulation of "Freon-12." The moisture condenses into water and drains off into an enclosed container or a permanent drain. The dried air passes over the con-

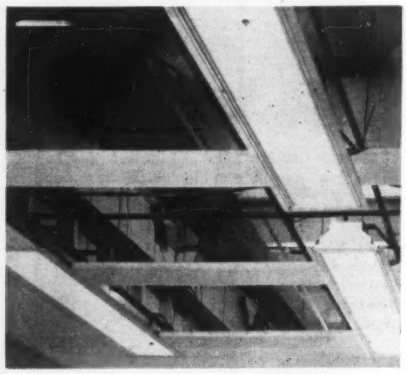


denser where it is warmed and discharged at room temperature. The dehumidifier circulates and filters the air whether it is set for dehumidifying or heating. It is mounted on casters and operates on 115 volts.

Manufacturer—Mitchell Mfg. Co., 2525 Clybourn Ave., Chicago.

Air Diffuser for Heating and Cooling

Air diffuser called "Linear Multi-Vent Panel," for heating, cooling and ventilating, used with Celotex "Acousti-Line" ceilings. . . .The use of flush perforated panel as a diffusing plate eliminates protruding air outlets and grilles. The flexible, compressible tubing supplied with the panels



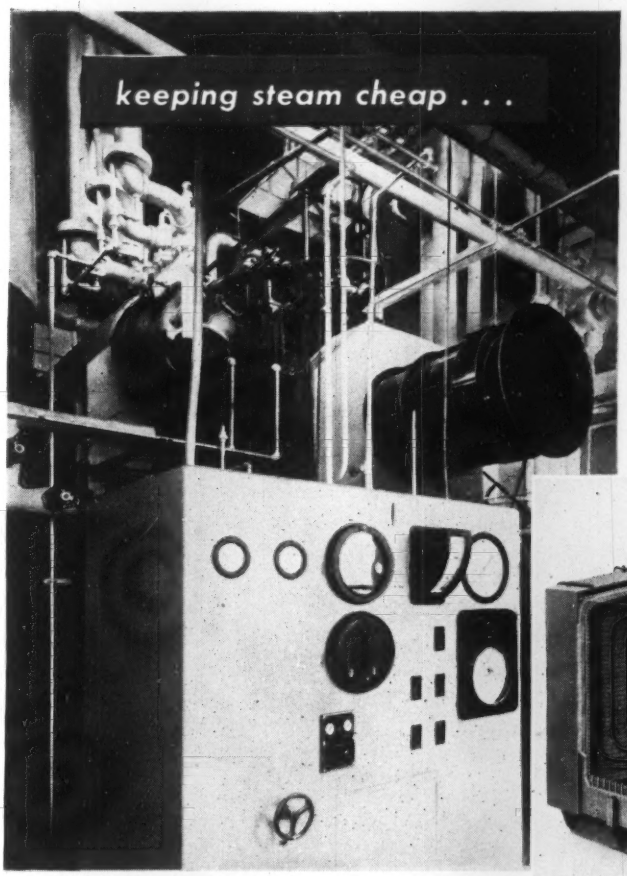
for use with duct air supply, reduces installation costs by eliminating the need for sheet metal work, the manufacturer states.

Manufacturer—The Pyle-National Co., 1334 N. Kostner Ave., Chicago 51.

Bellows Type Packless Valve

Bellows type packless valve for vacuum, high pressure, high temperature and low temperature systems . . . . The all-metallic construction of these valves eliminates the use of packings. They are designed in hand operated or pneumatic-hydraulic models. The hand operated valve features a ball joint

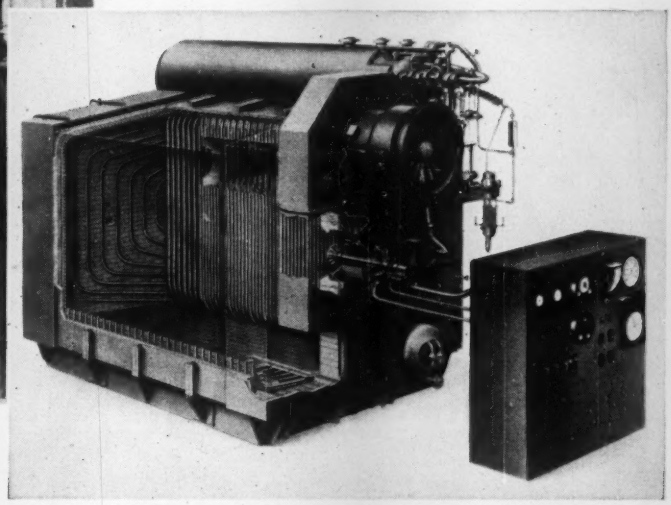
[*Continued on page* 208]



One of the three B&W FM Boilers at the Buffalo Plant.

B&W Type FM Boilers Provide Economical and Efficient Steam Generation at

American - Standard



Typical arrangement showing sectional view of the FM Boiler and the control panel.

Since replacing five old units more than a year ago, three modern B&W Integral-Furnace Boilers, Type FM, have set and sustained high standards for economy and operating efficiency at the Stamping Plant of the American Radiator & Standard Sanitary Corporation in Buffalo.

Selected on the basis of previous experience with B&W Boilers—both FM and larger types—which are now producing steam at various other plants of the company, this multiple-unit FM installation has pleased both management and plant personnel. Overall boiler operating efficiency is 85%. Each of these versatile, self-contained, B&W units has a steam capacity of 27,500 lb per hr and is equipped with fully automatic controls. Designed for pressures to 250 psi, all three FM boilers are providing high pressure processing steam as well as steam for heating.

The choice of B&W FM boilers to supply plant steam requirements is an established trend that is putting more and more of these shop-assembled units into service for the broadest variety of industries, utilities, and other users, both here and abroad. Because it offers compact, "package boiler" benefits along with cost-saving big boiler advantages, B&W's FM Boiler is already in service or on order for a total steam capacity of more than 7,000,000 lb per hr. You can get this unique B&W "workhorse" in a range of standard sizes, for loads from 2900 to 28,000 lb of steam per hr at pressures to 235 psi. It is also obtainable for operation at higher pressures.

Features of B&W Integral-Furnace Boiler Type FM

- Saves Erection Time and Cost
- Meets Wide Range of Service
- Handles Quick Load Changes
- Suitable for Outdoor Service
- Safe, Automatic Operation
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space

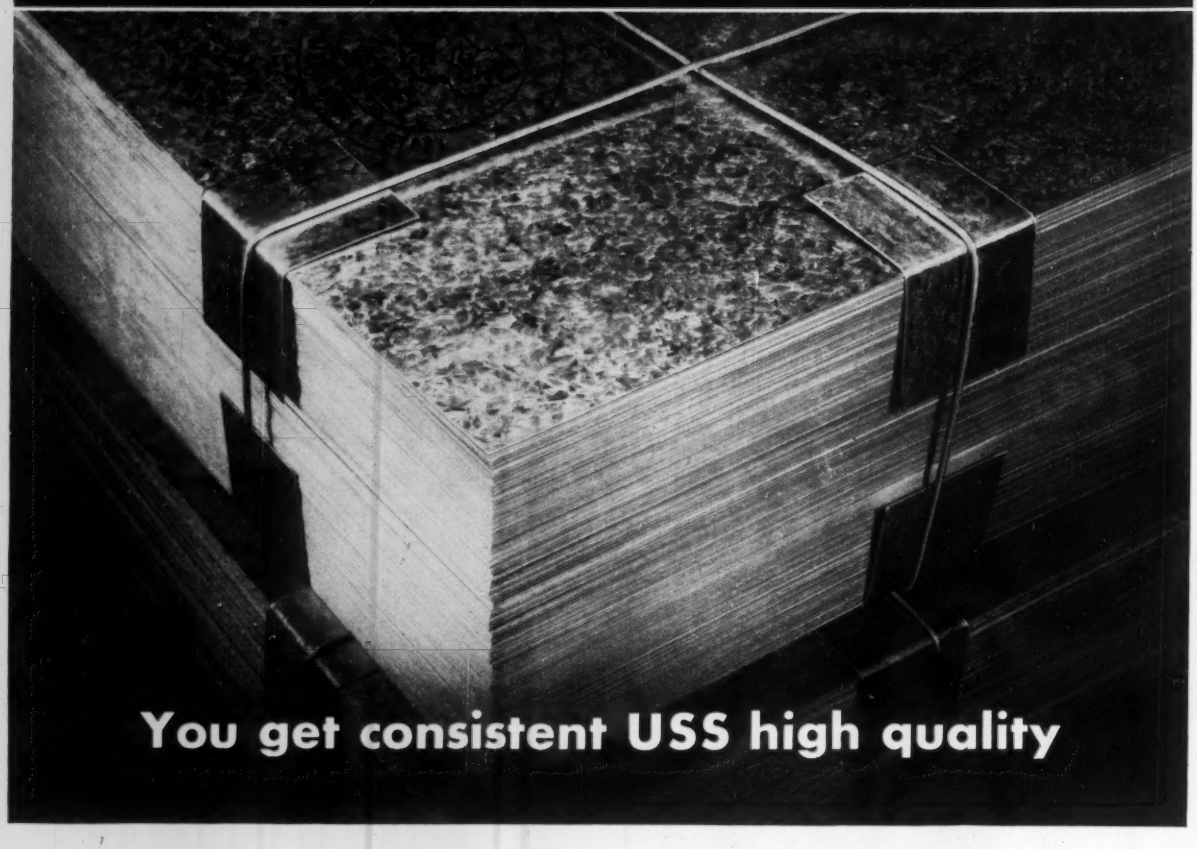
Write for Bulletin G-76 which gives complete details of the many cost-saving features of this popular, small boiler. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

G-634

BABCOCK & WILCOX

BOILER DIVISION

WHY IT PAYS TO BUY SHEETS and STRIP FROM US



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• All the sheets and strip that we sell are the dependable, top quality products of United States Steel—manufactured under close quality control that insures uniformity. And we, at U. S. Steel Supply, make certain that their quality is intact when you get your order . . . our sheets and strip are stored right and bundled right to arrive in top shape.

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Next time you want good, dependable steel with service to match, contact U. S. Steel Supply. Call us for: hot rolled, cold rolled, Vitrenamel, galvanized, galvannealed, paint bond, corrugated, long terne sheets, and hot rolled or cold rolled strip.

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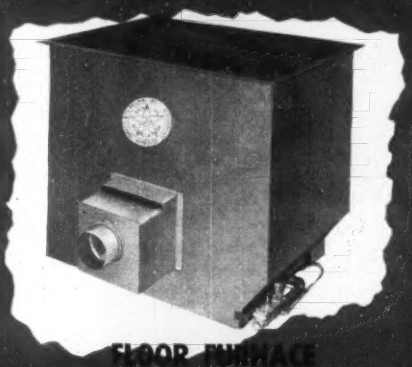
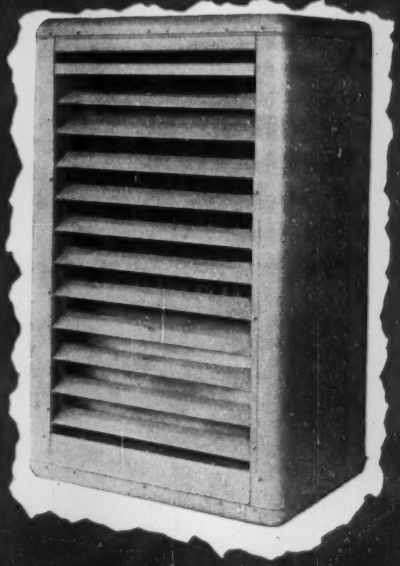
JZ A John Zink Heat Maker for Any DOMESTIC INSTALLATION JZ



FLOOR FURNACE

A Size for Every Home Heating Requirement
Small Floor Grille — Fool Proof
Simple to Operate — AGA Approved
Sturdy Construction — Sizes —
55,000 Btu input
90,000 Btu input
65,000 Btu input

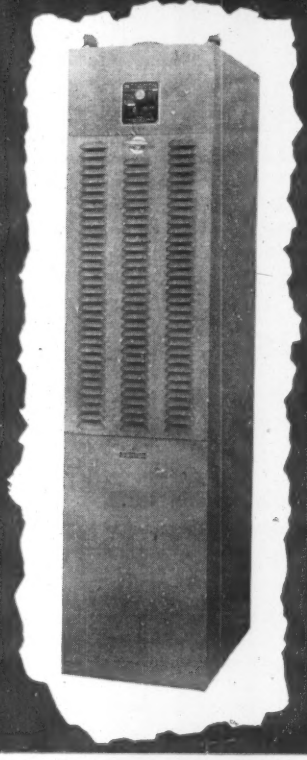
Suspended UNIT HEATER Series UHS Fan Type



For clean, safe, trouble-free heating of industrial and commercial establishments, gas-fired suspended heaters have proven themselves and the New John Zink UHS Gas-fired Suspended Heaters assure customer satisfaction. A complete, packaged unit fully automatic, the heaters are suspended from the ceiling to conserve valuable floor space and yet are designed so that they will be an attractive addition to any shop or store.

Heaters for all gases except LPG are equipped with automatic safety shut-off valves that are really automatic. All you have to do is open the pilot light cock and light the pilot. The shut-off starts itself automatically — no buttons to push or hold down. For LPG operation, heaters are equipped with 100% safety shut-off valves.

AGA Approved for Natural, Mixed, Manufactured or LP Gas



Central GAS HEATERS

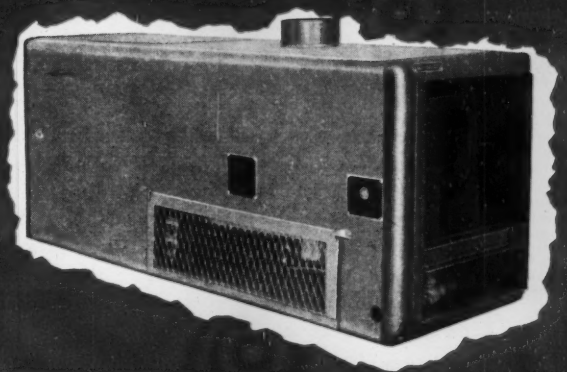
Here is truly a universal, efficient, simple, and compact CENTRAL HEATING UNIT. Fully automatic, it is a complete packaged unit ready for installation. The two heaters shown are almost identical in operation and design of the heat exchanger. The two different types of casings are furnished to meet requirements for a particular application.

Heaters may be installed in the basement, attic, service closet, or utility room of a home. The AF-110 may be installed even under the house if certain provisions are made for the draft diverter. For industrial applications, it may be installed on a shelf or balcony; as a suspended heater and as a duct heater.

Each John Zink Central Gas Heater is equipped with an automatic safety shut-off that is really automatic.

The John Zink Central Gas Heater is designed as a winter air conditioner with a summer switch to provide air circulation during warm weather.

John Zink now offers a new, highly efficient BLUE FLAME CONVERSION BURNER for converting solid fuel furnaces to gas. John Zink burners are protected by more than 60 U. S. Letters of Patent. It's easy to supply your customers from the John Zink line.

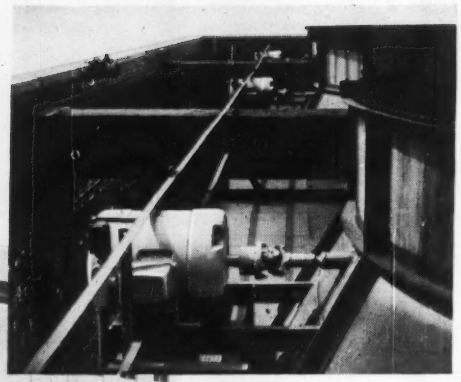


Write for literature

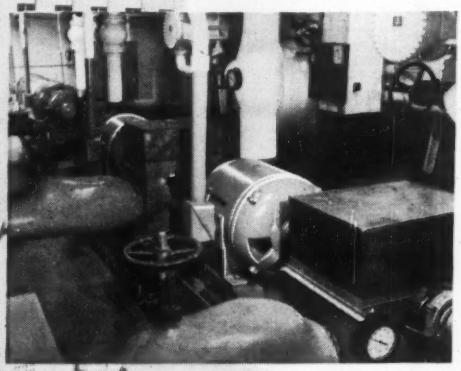
JOHN ZINK COMPANY

4401 South Peoria — Phone: Z-4333-4-5 — John 15, Okla.

Below; The Dun & Bradstreet Building—located at 99 Church St., New York City. Owner: Dun & Bradstreet, Inc. Builder and General Contractor: George A. Fuller Co. Consulting Engineers: Syska and Hennessy. Architects: Reinhard, Hofmeister and Walquist. Mechanical Contractor: Kerby Saunders, Inc.



Three 20-hp, 1760-rpm Squirrel-cage Splash-proof motors driving cooling tower fans on the roof of the Dun & Bradstreet building.



Four 100-hp, 1750-rpm Squirrel-cage protected-type motors driving two 1400-gpm condenser water pumps (foreground) and two 1750-gpm chill water pumps (rear). These are in the second basement of the Dun & Bradstreet building.

this air conditioning system uses...

ELLIOTT CROCKER-WHEELER MOTORS

Wherever the wheels of business turn, Dun & Bradstreet, Inc., is on the job. This new office building at 99 Church Street, New York City, serves as both their National and New York District Headquarters. The modern, completely air conditioned building assures pleasant, comfortable working conditions for approximately two thousand Dun & Bradstreet employees.

The components of this air conditioning system utilize approximately 60 Elliott Crocker-Wheeler motors of various horsepower ratings. They drive intake fans, exhaust fans, condenser water pumps, and window unit pumps. Your local Elliott representative is ready to acquaint you with the merits of Elliott Crocker-Wheeler motor applications in air conditioning systems; or write Elliott Company, Crocker-Wheeler Division, Ampere, New Jersey.

ELLIOTT Company

W4-5

TURBINE-GENERATORS TURBINES MOTORS GENERATORS DEAERATING HEATERS EJECTORS CONDENSERS COMPRESSORS TURBOCHARGERS TUBE CLEANERS STRAINERS

COAL HEAT
produced with a
WILL-BURT STOKER
IS LOW COST HEAT...

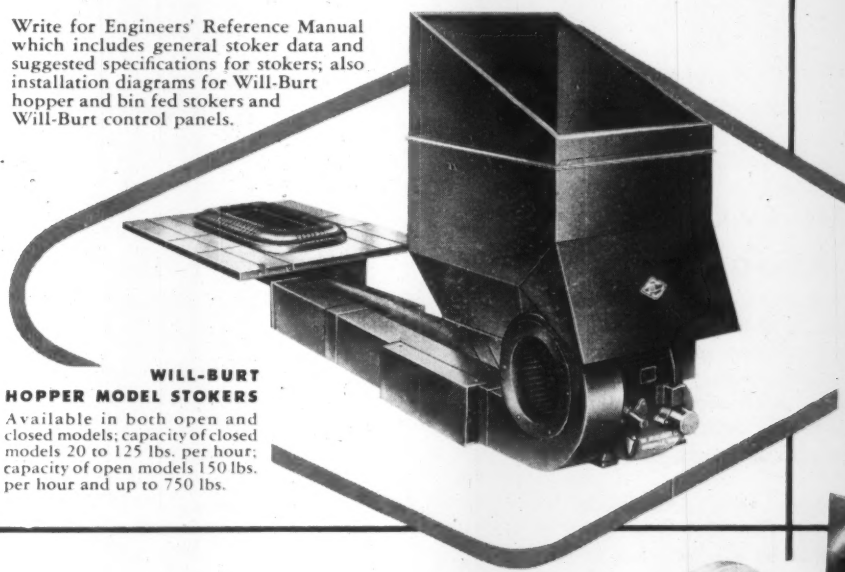
Heat generated by means that assures a factor of greater safety at all times

Will-Burt Stokers give relief from time-wasting grief at the installation stage and throughout the heating season. They are engineered for application to various types of bituminous coal burning boilers and furnaces. They represent over 25 years of experience in designing and manufacturing automatic stokers and are widely known for dependable trouble-free performance, particularly in installations in schools, hospitals, greenhouses, churches, country clubs, apartments and small factory buildings.

Will-Burt Stokers assure efficient combustion under ever-changing fuel bed conditions. The Will-Burt Patented Automatic Air Control delivers correct quantities of air for the most efficient combustion during operating and off periods. Air induced by natural draft through the Automatic Air Control when the blower is idle is sufficient to *prevent a condition of smoke and soot* such as is usually prevalent when the fire is starved for air.

A factor of great safety in automatically controlled heating is assured with Will-Burt Stoker safety devices and control panels. Will-Burt Stokers are available in open and closed hopper models and a bin fed model.

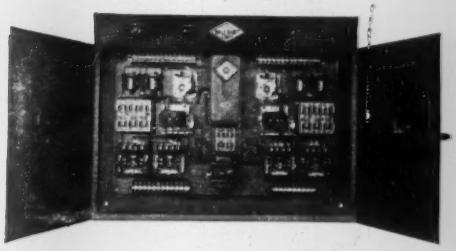
Write for Engineers' Reference Manual which includes general stoker data and suggested specifications for stokers; also installation diagrams for Will-Burt hopper and bin fed stokers and Will-Burt control panels.



WILL-BURT HOPPER MODEL STOKERS

Available in both open and closed models; capacity of closed models 20 to 125 lbs. per hour; capacity of open models 150 lbs. per hour and up to 750 lbs.

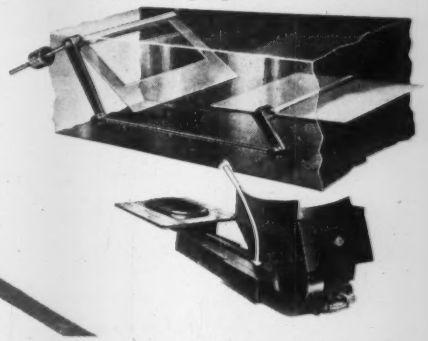
Coal Fired with a Will-Burt Stoker *is the Preferred Method of Heating* Wherever Safety in Heating is of Utmost Importance



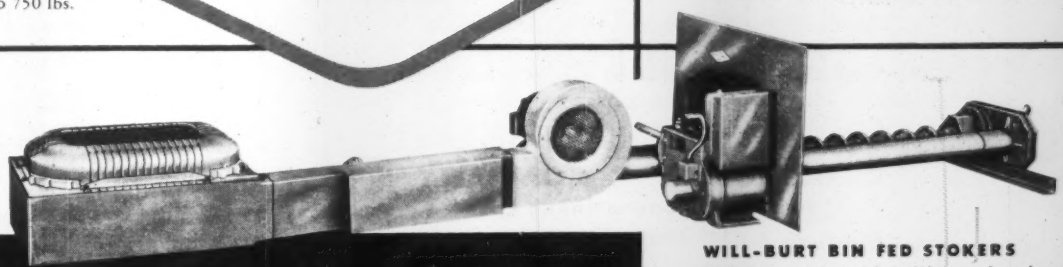
Will-Burt controls provide limiting and operating controls which may be set to obtain maximum efficiency in use of fuel and to coordinate operation of blower, Automatic Air Control and stoker under varying operating conditions. These controls combined with Will-Burt Safety Devices make this method of generating heat a positively safe one—a method preferred for schools, hospitals, institutions, and wherever safety in heating is of utmost importance.

●

Will-Burt Patented Automatic Air Control *Assures the Most Efficient Combustion* of Bituminous Coal Under Ever-Changing Fuel Bed Conditions



The Automatic Air Control assures proper combustion of fuel during the operating period and also during the time the blower and stoker feed screw are off. Air induced by natural draft through the Automatic Air Control when the blower is idle is sufficient to *prevent a condition of smoke and soot* such as is usually prevalent when the fire is starved for air. The Will-Burt Automatic Air Control allows enough of the normal draft to pass through and into the retort which in turn allows for the dissipation of any intense heat that may be surrounding the tuyeres or dead plate at the time the blower shuts off. This reduces boiler repair cost by retaining more uniform boiler and furnace firebox temperatures.



WILL-BURT BIN FED STOKERS

Reduce cost of coal handling and maintenance to an all-time low. Widely used throughout the nation and in several foreign countries with various types of bituminous coal burning boilers and furnaces.

The **WILL-BURT** *Company*

OVER TWENTY-FIVE YEARS IN THE STOKER BUSINESS

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Yes, regardless of your product need, you'll find HUSSEY COPPER is produced in the form you require. Sheet, strip, coils, bars, rods, wire . . . even plating anodes. Yes, in all commercially used grades, too, and in a highly refined quality that smooths out production, and increases your product quality.

Specify Hussey Copper with confidence for every copper application. Completely stocked in key industrial areas, Hussey Copper is "on the job" to fill your specifications.

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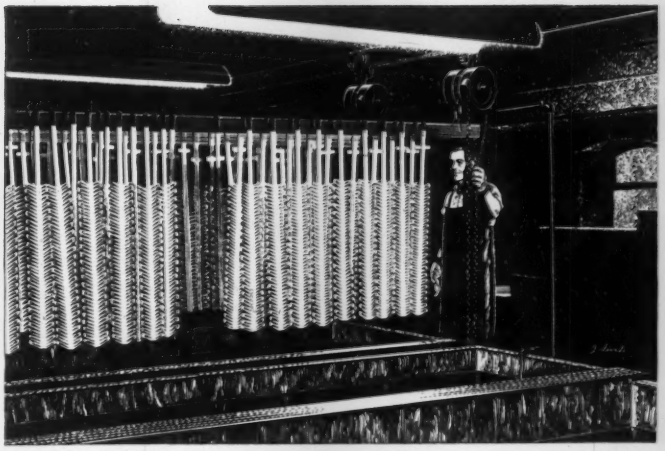
1632 Fairmount Avenue
NEW YORK (13)
140 Sixth Avenue
CHICAGO (18)
3900 N. Elston Avenue
CINCINNATI (2)
424 Commercial Square



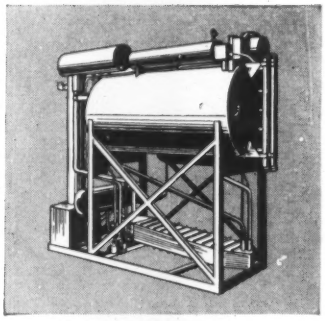
Servel

WELCOMES...and SOLVES

tough industrial cooling problems

When Colonial Alloys Company of Philadelphia decided to anodize aluminum products by the new and different Electrodizing Conservation or "EC" process, it faced the problem of maintaining proper temperature of the electrolytic bath solution.

To meet this essential requirement, Colonial Alloys chose a Servel 25-ton Water Chiller. Not only does this single Servel Air Conditioning unit maintain constant, controlled solution temperature, but it also provides office air conditioning, chilled water for experimental work, and cold drinking water.



The 25-ton Water Chiller used in the Servel installation at Colonial Alloys Company.

Colonial Alloys reports that the new "EC" process, in which Servel equipment plays such a leading part, has *increased aluminum anodizing production as much as five times, while cutting costs as much as 99%!*

This is one of many examples of how Servel Air Conditioning equipment benefits industry. Chances are, your problem can be solved in an equally satisfactory manner. Because Servel Air Conditioning *uses heat to produce cold*, operating economy is outstanding. It operates on gas, oil, steam or waste heat—whichever is the most economical fuel in your area. There are *no moving parts* to wear or cause vibration. And every Servel unit carries a complete *five-year warranty*.

★ ★ ★

Servel manufactures the world's finest air conditioning equipment to fit all air conditioning needs—residential, industrial, commercial—all-year or cooling alone. For complete information, clip and mail the coupon today.

Servel

the name to watch for great advances in—

AIR CONDITIONING ✓ REFRIGERATION

SERVEL, INC., DEPT. HP-84 Evansville 20, Indiana

I want to know more about industrial uses of Servel Air Conditioning.

Name_____

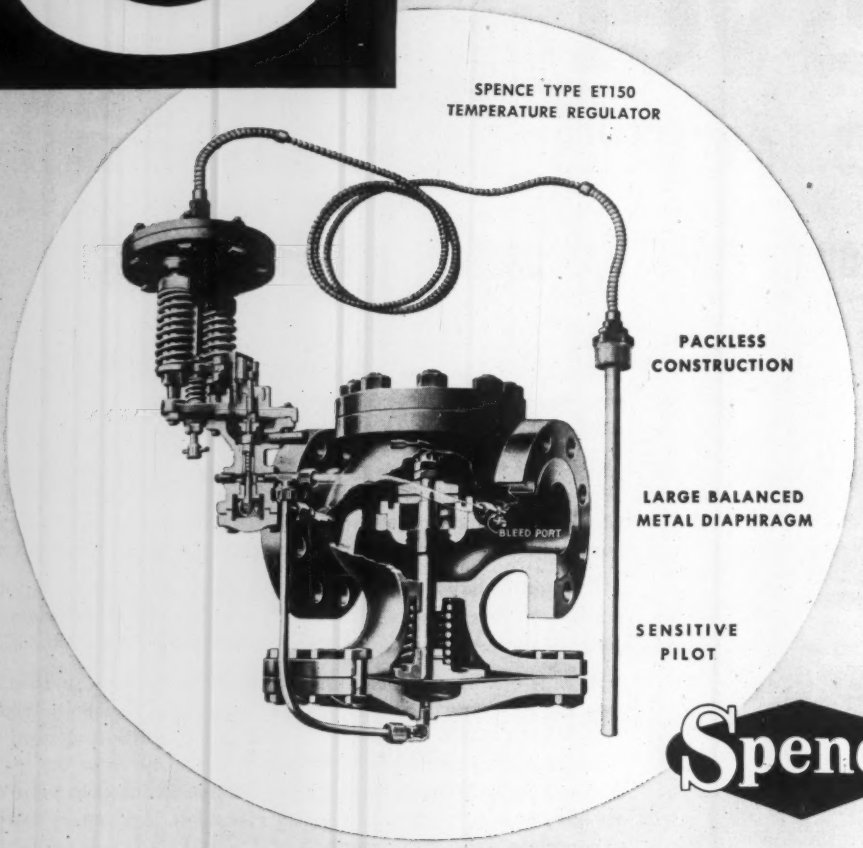
Title_____

Company Name_____

Address_____

City_____ State_____

3 Reasons for Accurate Regulation



Packless construction eliminates the need for closely fitted parts that may stick or bind due to dirt or uneven expansion of the parts.

In Spence Temperature Regulators, the Main Valve is actuated by a large balanced metal diaphragm which responds to the slightest changes in temperature.

Sensitive Pilots are designed to limit heater pressure to an adjustable maximum. As the temperature at the thermostat drops a few degrees there is a corresponding increase in steam pressure up to the limit for which the Pilot is set.

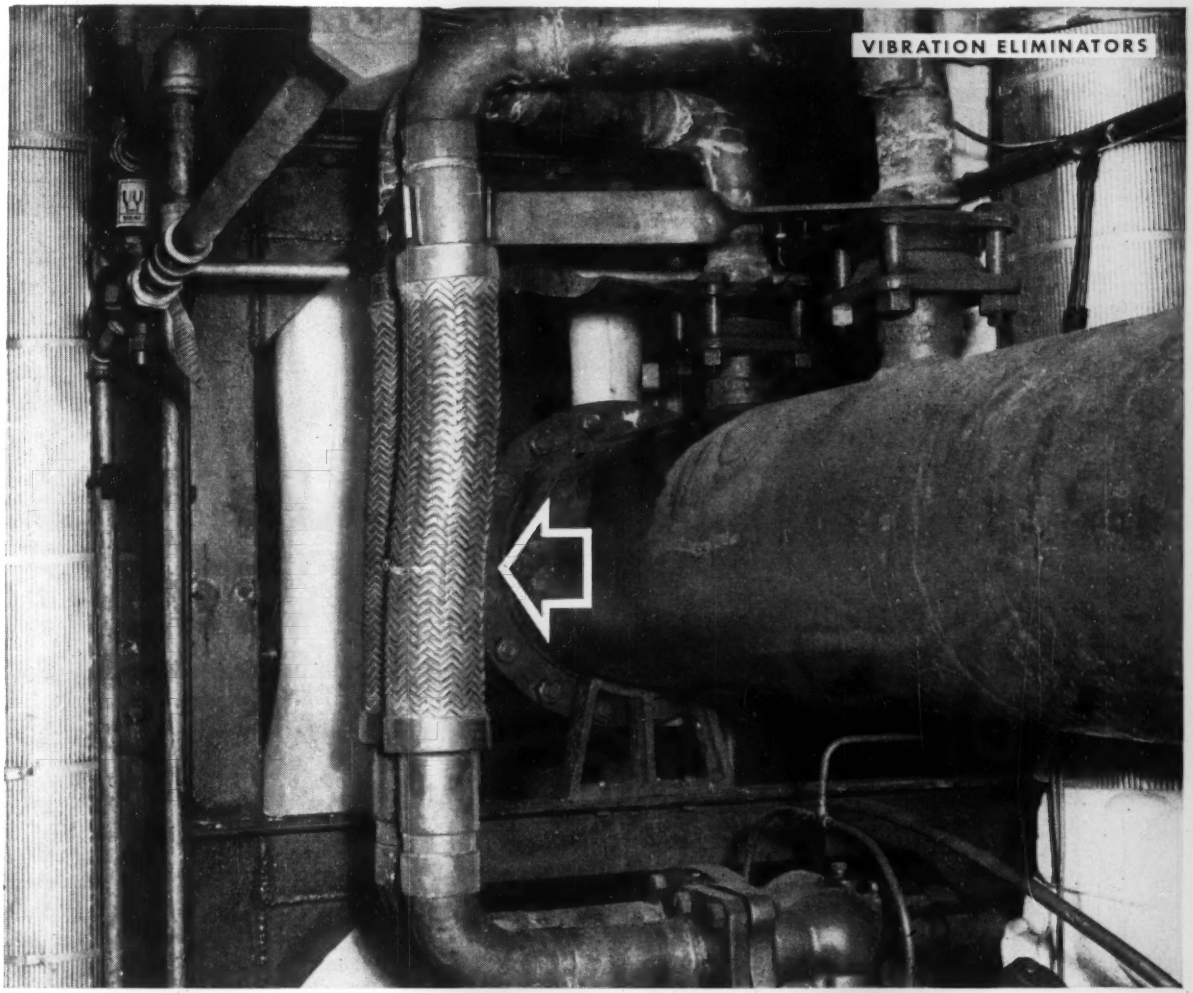
With regulators that respond only to temperature, an increase in load is accompanied by a momentary decrease in steam pressure caused by faster condensation in the heating element. There is a time lag until the thermostat senses the temperature drop and opens the valve wider. Spence Temperature Regulators act like pilot operated pressure regulators when this occurs. They respond instantly to maintain the steam pressure until the thermostat has a chance to further increase it as needed for the heavier load.

These plus other design features explain why Spence Temperature Regulators function dependably and accurately year after year, without requiring extensive repairs or special attention.

Want more facts? Write for Bulletin T50 giving full details.

SE128

SPENCE ENGINEERING COMPANY, INC., Walden, New York



COMPRESSED FREON-22, used to chill brine, is pumped to condenser through two 2½" American Vibration Eliminators. Freon gas returns to compressor through a 3½" American VE (not shown).

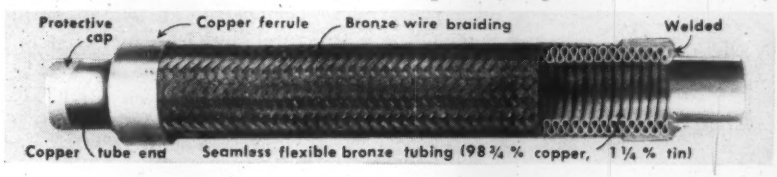
Vibration from 40-hp compressor can't crack this piping protected by American Vibration Eliminators

When you line up a compressor this size—no matter how good the installation—there's sure to be plenty of kick left in it. This unit pounds away at 40-hp and sets up considerable vibration . . . enough to be a menace to rigid refrigerant lines.

Engineers of Hoffmann-La Roche, Inc., Nutley, N. J., manufacturers of pharmaceuticals and vitamins, used two American Seamless Flexible Bronze Connectors — called Vibration Eliminators—to solve the problem here.

These flexible connectors allow for expansion and contraction in rigid lines. They absorb and dampen vibration . . . muffle noise. Refrigerant lines are guarded against fatigue-cracking. American Vibration Eliminators are leakproof, too. That's especially important here, since they carry costly Freon-22 under a working pressure of 210 lb.

Leading wholesalers stock packaged American Vibration Eliminators to fit standard copper tube sizes. For more information, write for Bulletin VE-310R to: *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn. In Canada: The Canadian Fairbanks-Morse Co., Ltd.* 54227



WHEREVER CONNECTORS MUST MOVE

AMERICAN

flexible metal hose and tubing

an ANACONDA® product

USE PROPANE?

USE THIS TORCH-O-MATIC

USE ACETYLENE?

USE THIS TORCH-O-MATIC

Whichever Torch-o-matic you use —exclusive trigger-control saves you time, saves you fuel

With either the Propane or Acetylene Torch-o-matic, you get the *exclusive trigger-control* feature that saves time, saves gas, adds safety to every job.

The instant you pull the trigger, the flame lights, and you're ready to go to work. No matches, no adjusting, no time wasted. Release the trigger and the flame shuts off. And with the Propane Torch-o-matic, a special two-stage valve lets you increase the flame from a pinpoint to a full 6 inches in length simply by pulling the trigger completely back.

Add it up and you can quickly see how the AUTOMATIC ON-OFF trigger-control puts you ahead when you're using Torch-o-matic, saves you gas when you're not.

The Acetylene Torch-o-matic fits your present equipment, features a wide selection of nozzles for every job. The Propane Torch-o-matic connects directly to your propane tank—no intermediate valve fittings are necessary. Write for details.

VELOCITY POWER TOOL CO.

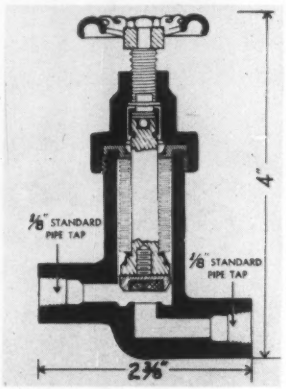
201 Howe Braddock Avenue

Pittsburgh 8, Pa.

EQUIPMENT DEVELOPMENTS

Continued from page 198

construction in the handle to prevent torque from being trasmitted to the bellows and valve stem so that the valve is seated by a straight vertical thrust with no rotating motion. Standard models are rated for pressures up to 150 psi and for temperatures from

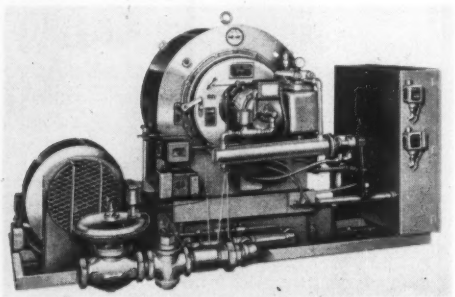


−65 F to 250 F. Inlet and outlet fittings are ⅛ in. female pipe taps on both valves as is the actuating pressure line connection on the pneumatic-hydraulic valve.

Manufacturer—Clifford Mfg. Co., Grove St., Waltham 54, Mass.

Forced Draft Packaged Burner

Forced draft packaged burner built to specifications for scotch marine type boilers and other types of heat receivers designed for pressurized operation . . . . Burner specifications may be selected to burn any grade of fuel oil, high or low pressure gas, or a combination. The package includes a burner, forced draft fan, windbox with integral refractory,



enclosed wired control panel, ignition and electronic safeguard systems, and constant velocity type air control assembly. All components are wired, piped and mounted on a structural steel base ready for installation on the boiler front. Only connections to be made are those for steam, water, electricity and fuel.

Manufacturer—Ray Oil Burner Co., 1301 San Jose Ave., San Francisco 12.

EQUIPMENT DEVELOPMENTS

Continued

Insulation Tape

"No. 8525 Den-ite" insulation tape for cold lines in air conditioning systems or wherever the problem of condensation arises . . . . The company states that the tape acts as a sound deadening barrier and has been used as a gasketing material. It reportedly has good adhesion to itself and all types of surfaces. No supplemental adhesives are required.

Manufacturer—Dennis Chemical Co., 2701 Papin St., St. Louis 3.

Air Conditioner

Commercial and residential air conditioner designed for use with any type of warm air furnace . . . . Known as the "FAC," it is available in 2 and 3 ton capacities. The refrigeration unit can be connected either to a cooling tower or normal water supply. Because the unit is designed to house its own fan, it can be used with a gravity type warm air furnace as well as a forced air system. When used with the gravity type, the existing floor face plates are replaced with standard air conditioning grilles. Use of the unit with a forced air system requires connection to existing ductwork. The 2 ton unit has a capacity of 24,000 Btu per hr and the 3 ton model is rated at 36,000 Btu's.

Manufacturer—Union Asbestos & Rubber Co., Heating and Cooling Div., 332 S. Michigan Ave., Chicago.

Centrifugal Pump

Compact, close coupled centrifugal pump added to "Electropump" line. . . ."Model BB" is designed for air conditioning cooling towers and other applications. The pumps of 1½ in. discharge, in 2, 3 and 5 hp sizes, have capacities up to 150 gpm and heads up to 140 ft, the manufacturer states.

Manufacturer—Carver Pump Co., 1460 Hershey Ave., Muscatine, Iowa.

Between the two Bigelow boilers shown stands almost a century of boiler-making experience. During those years, Bigelow's reputation has been written in steam by thousands of successful, efficient and long-lived boiler installations all over the world.

What This Means To You

When you are in the market for a new boiler, you will benefit by what has happened in the time between these two boilers. You will get the advantage of the experience and progress in design, construction and inspection embodied in Boilers By Bigelow.

Write for free catalogs on any of the units listed.

THEN
This coal-fired boiler was one of the earliest Boilers By Bigelow.

NOW
Bigelow boiler installed recently at Waterbury Hospital, Waterbury, Conn. Capacity 23,000 lbs. steam per hour. Oil-fired.

Boilers By Bigelow

Water Tube Boilers—Bent Tube Types
Horizontal Return Tubular Boilers
Scotch Type Boilers
Two-Pass Boilers
Electric Steam Generators

K-3

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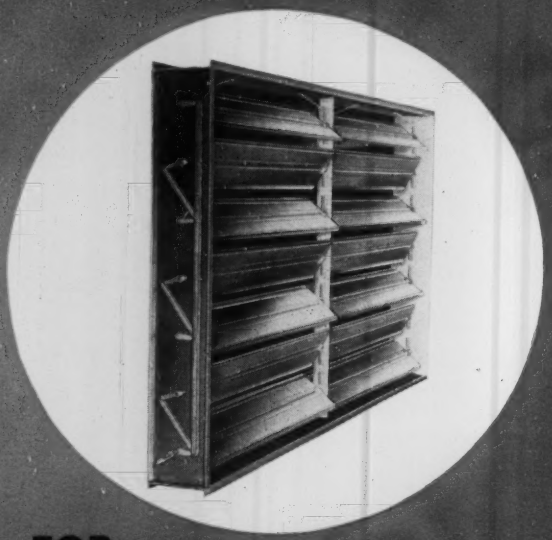

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439 MADISON AVE. NEW YORK 22, N.Y.
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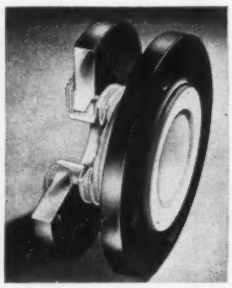
EQUIPMENT DEVELOPMENTS *Continued*

Small Oil Fired Unit Heaters

Addition of 10 smaller sizes to line of oil fired unit heaters using a conventional gun type oil burner. . . . Only models formerly available had an output of 200,000 Btu per hr. New sizes have output ratings from 196,000 Btu down to 112,000 Btu per hr. The units are provided with adjustable louvers to control the direction of the heated air. All units are completely wired at the factory. Varying outlet air temperatures and noise levels are available for particular installations. The larger units weigh 450 lb complete with burner, and the small size units weigh 375 lb complete.

Manufacturer—Delta Heating Corp., Cole St. & Reading R. R., Trenton 8, N.J.



Above: Bellows
Right: Heater

Corrosion Resistant Bellows, Flanges

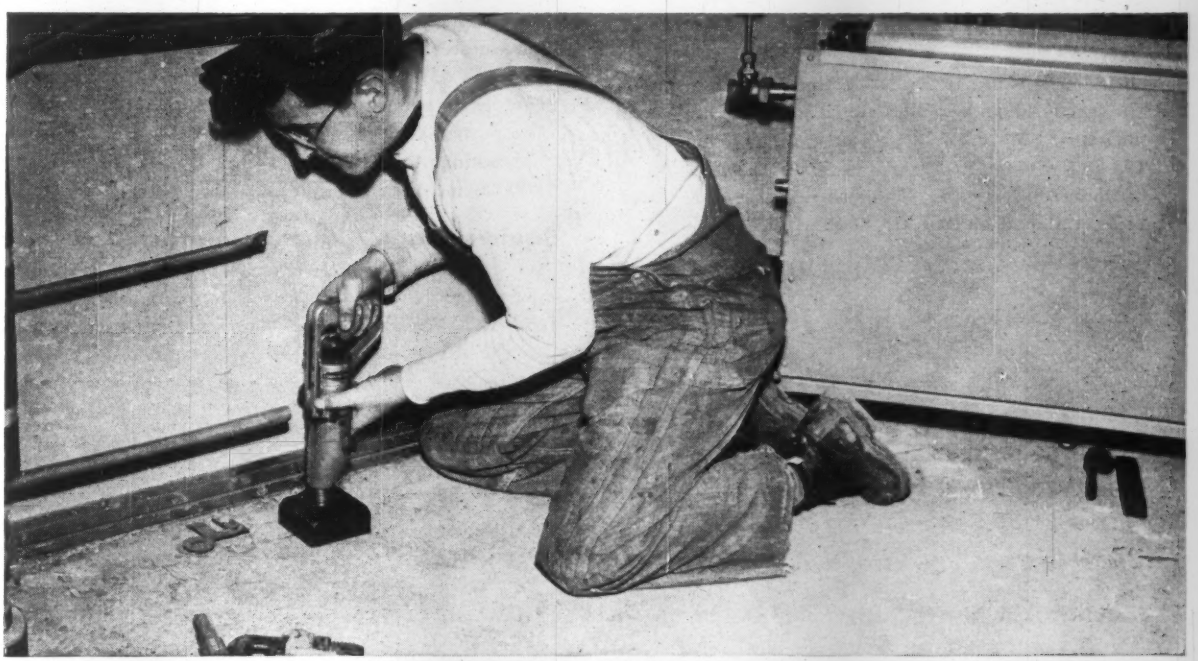
Chemically inert, corrosion and heat resistant bellows made of "Teflon" now available with companion flanges conforming to American Standard bolt hole circles and numbers for pressures up to 125 psi. . . .The company states that the bellows expand and contract in either direction with equal freedom of motion. Operating temperature range is −94 to +500 F.

The bellow flanges are of French-type gasket construction designed to provide efficient sealing at lower flange pressure. Gasket insert material is asbestos or synthetic rubber.

Manufacturer—Crane Packing Co., Dept. HCC, 1800 Cuyler Ave., Chicago 13.

Air Control Valve

"Lifeguard" air control valve which shuts off when any component does not operate normally. . . .A safety unit attached to the pilot section casting cuts off the air supply to the pilot section in case of failure of any valve part. It cannot be actuated until the seal on the recock unit is broken and adjustments made. The new valve, an a-c solenoid, pilot operated, three way model, consists of two valves in a common housing. It has a single inlet port, an out port, and two interconnected exhaust



Cut fastening costs up to 80% on heating and air conditioning installations...with the REMINGTON STUD DRIVER

"It saves us money on every fixture we install" —that's the kind of report we're getting every day on the Remington Stud Driver. Big savings just naturally result from the amazing speed of this powder-actuated tool. It sets as many as 5 studs a minute in steel or concrete!

You'll find real economy, too, in the fact that the Stud Driver is completely self-powered—no need for extra equipment, wires or cables. Compact and portable, the tool is designed in every way for easy handling. And since it weighs only 6 pounds, it's ideal for working overhead and in confined spaces.

What's your fastening job? Whether it's fastening pipe to walls and ceilings or anchoring fixtures to concrete floors, you'll save money with the Remington Stud Driver. For complete information on how to cut *your* fastening costs, just send in the coupon below.

QUESTIONS YOU ARE ASKING

QUESTION:
What are the studs made of?

ANSWER:
Genuine Remington studs are made of a selected molybdenum-bearing alloy steel, heat-treated for required hardness and ductility properties. All are plated for protection against corrosion.

"If It's Remington—It's Right"

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MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. HPAC-8
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Please send me free copies of the new booklets showing how I can cut my fastening costs.

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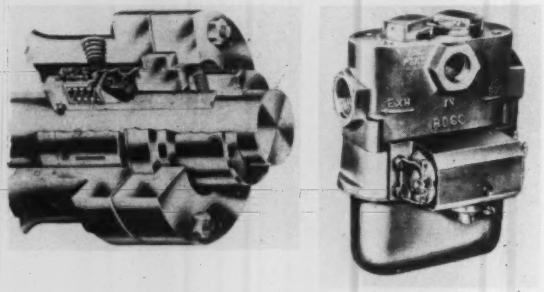
*City*_____ *State*_____

EQUIPMENT DEVELOPMENTS

Continued

ports. There are two pilot sections with a common air supply, but with individual exhaust ports and solenoids. Main valve pressures range from 30 to 125 psi, with pilot pressure of 40 to 125 psi.

Manufacturer—Ross Operating Valve Co., Dept. 1403, 120 E. Golden Gate St., Detroit.



Above: Valve
Left: Seal

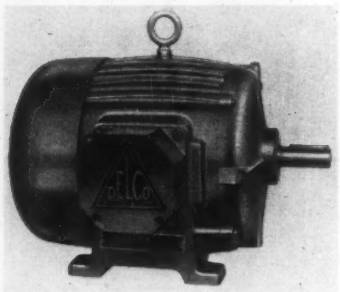
Mechanical Shaft Seal

"Type 9" mechanical shaft seal mounted on a sleeve with an outside clamping ring to permit quick installation or removal in almost all split-case pumps. . . .This is possible because it is not necessary to unbolt the top of the horizontal split shell. According to the company, the seal can be used to handle practically all corrosive liquids at temperatures up to 500 F. Flexible sealing members are made of chemically inert "Teflon." Spring and metal parts are furnished in the metals best suited for a particular application.

Manufacturer—Crane Packing Co., Dept. HCC, 1800 Cuyler Ave., Chicago 13.

Squirrel Cage Induction Motors

New line of a-c, squirrel cage, induction motors. . . .The new motors, in frame sizes from 182 through 326, are manufactured to meet the new NEMA standards. The open drip proof model features cast iron main and end frames, aluminum die cast rotors, grease lubricated double shielded ball

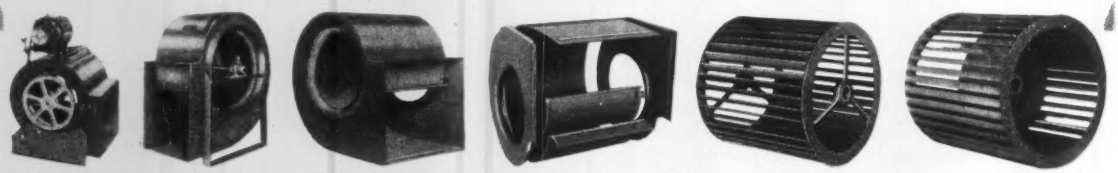


bearings, "Delcote" cotton and varnish insulation and a drip proof baffle, cast as part of the end frame,

The MASSACHUSETTS Line®

A.C. Blowers · DESIGN 2

FOR A COMPLETE SELECTION



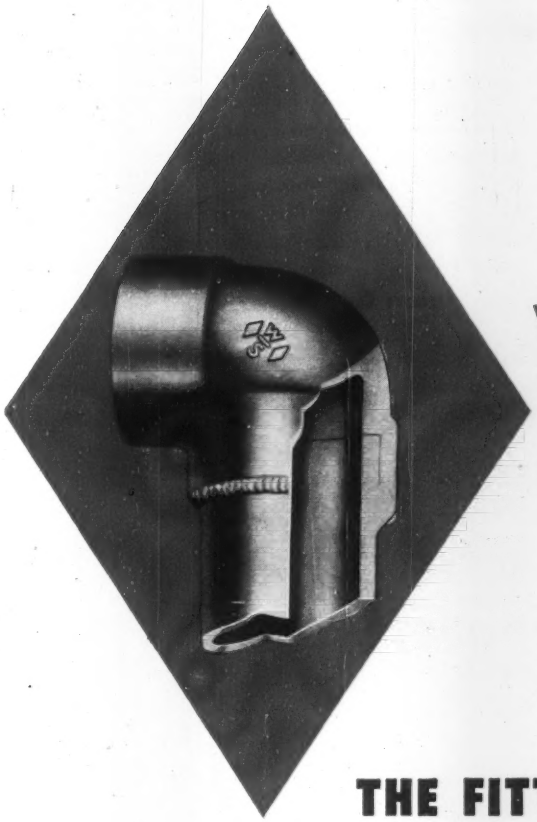
Complete Assemblies, Single, Double or Special Width; Housings, Housing Sides; Cutoff Plate; Scroll Sheet; Type "SP" Standard Wheel; Type "C" Wheel —for higher than normal speeds and pressures.

Pillow Blocks; Blower Pulleys; Motor Pulleys. Complete dimensional tables & NAFM approved ratings. *Write for Bulletin No. 115. Representatives in principal cities.*

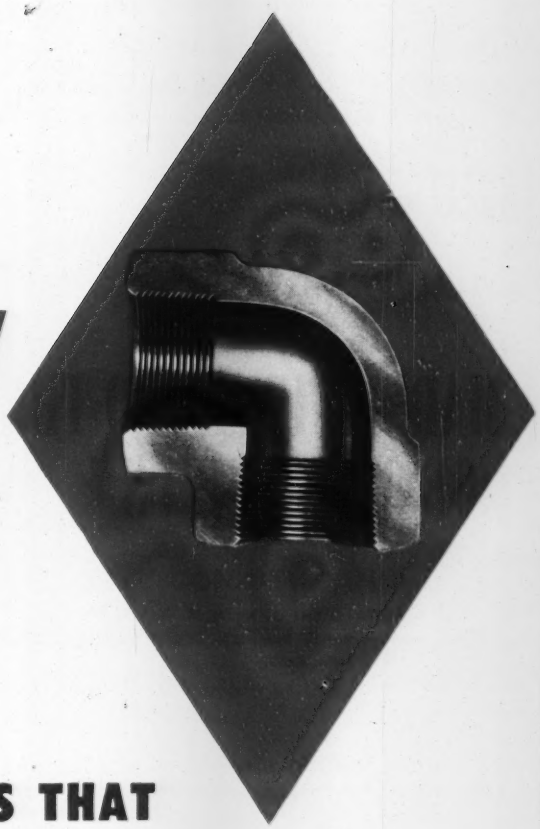
MASSACHUSETTS BLOWER DIVISION

The BISHOP & BABCOCK Mfg. Co.

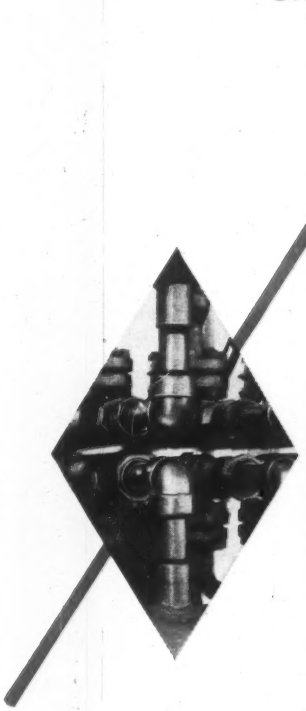
4901 HAMILTON AVENUE · CLEVELAND 14, OHIO



W-S



THE FITTINGS THAT CAN REALLY TAKE IT!



Every elbow, tee and cross in a high pressure piping system is a point of concentrated stress. W-S Forged Steel Fittings take this tough service in stride because they're fabricated and designed to resist pressure, heat, shock and vibration. They're drop forged of highest quality steel to produce a dense, tough, forged-fiber structure that can really take it. And careful heat treatment after forging develops the metallurgical properties of the steel to their fullest.

Notice, too, how Watson-Stillman engineers have designed extra strength into the fittings. Long bands extend well beyond the threads or sockets to provide extra reinforcement. Wall thickness is carefully calculated to put extra metal at points of severest stress.

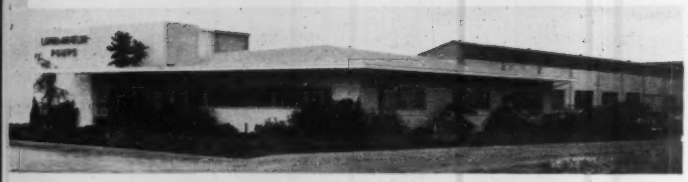
W-S high-precision machining and rigorous inspection follow through to give you the fittings that mean stronger, tougher pipe joints. W-S Forged Steel Fittings are available in both Screw-End and Socket-Welding types in carbon, stainless and alloy steels.

Sold Through Leading Distributors

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

Roselle, New Jersey



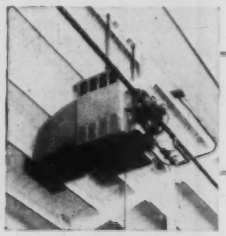
"Janitrol Engineering...

MADE 10 UNITS DO THE JOB OF 15 FOR US"

A STATEMENT OF Mr. H. M. Watkins, Manager, Layne-Bowler Pump Co., 2943 S. Vail, Montebello, Calif.

"For our new Montebello plant, Janitrol engineers took advantage of the quantities of stray heat from processing equipment that would have accumulated near the top of our saw-tooth roof. This pre-heated air was recirculated by Janitrol Gas-Fired Unit Heaters, placed near each roof peak, high above the floor. Janitrol engineers of Natural Gas Equipment, Inc., Pasadena, found that in this particular installation only 10 units were required, as compared with 15 when placed at the normal 8-foot height.

"This design saved us ⅓ on our original heating installation cost. And with fewer units, we've realized substantial fuel savings ever since."



Heat from these Janitrol Unit Heaters is directed to the floor with high velocity nozzles.

The experience of Janitrol engineer-representatives can help you select proper equipment to get more value from your heating investment. Whether you are building or remodeling, send us your problem. No obligation.

Janitrol Heating & Air Conditioning Division, Surface Combustion Corporation, Columbus 16, Ohio. In Canada: Alvar Simpson Ltd., Toronto 13

Janitrol GAS-FIRED UNIT HEATERS

ALSO MAKERS OF Surface INDUSTRIAL FURNACES Kathabar HUMIDITY CONDITIONING

EQUIPMENT DEVELOPMENTS

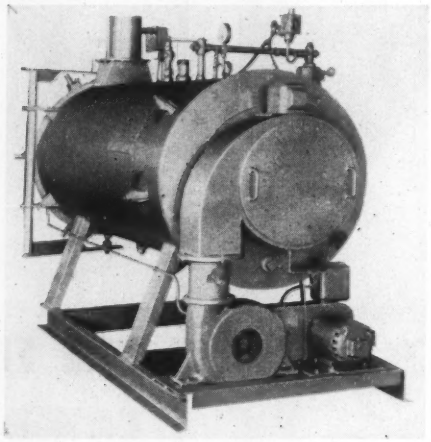
Continued

which protects the motor from dripping liquids. The totally enclosed fan cooled motor is built with ribbed frame construction which allows the external fan to direct air over the ribbed frame.

Manufacturer—Delco Products Div., General Motors Corp., 329 E. First St., Dayton 1, Ohio.

Small Steam Generator

Steam generator for small commercial applications in sizes ranging from 15 to 30 hp. . . . The "Steam-Pakette" can be used with light fuel oil, gas or combination firing. The change-over on the

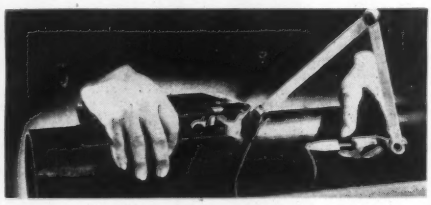


combination firing models is accomplished by throwing a switch. The units are designed for high pressure duty with a maximum design pressure of 125 lb and are delivered fully wired to the control panel.

Manufacturer—York-Shipley, Inc., York, Pa.

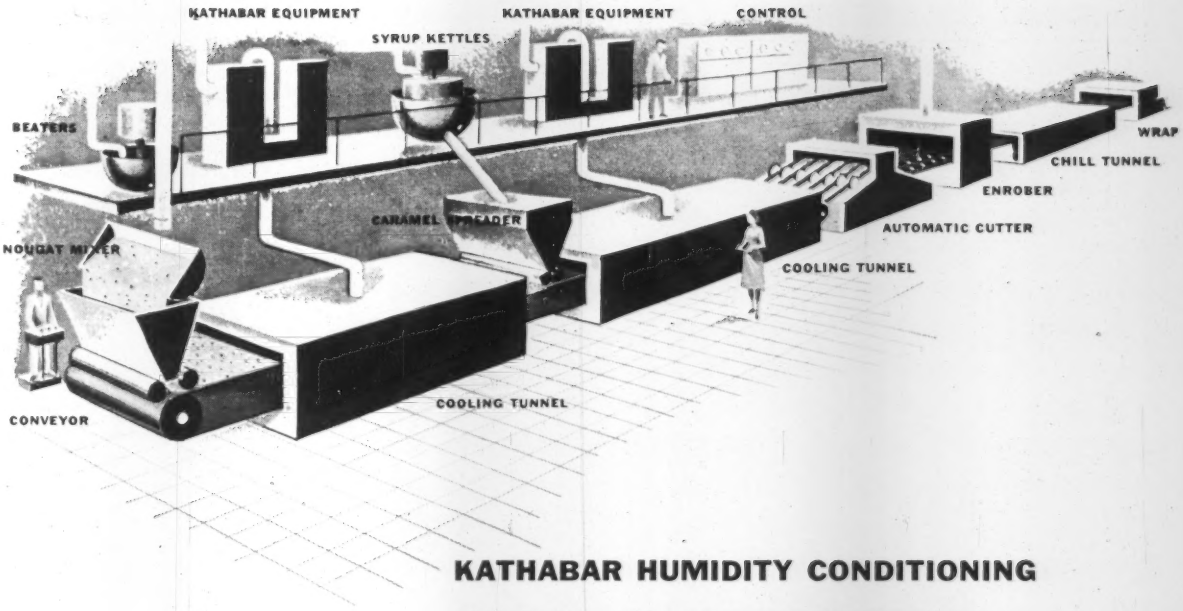
Tool for Laying Out Pipe Joints

Tool for precise layout of pipe joints. . . . A jointed arm with soapstone point and a dial marked in both degrees and pitch are mounted on a base which is curved to rest on the pipe. When the dial is set to the desired angle, the arm traces the



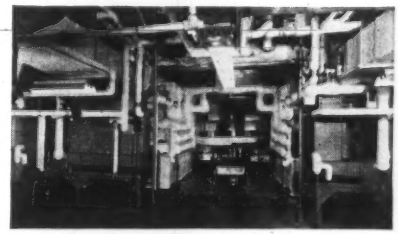
cutting line around the pipe. The company states that the average pipe joint can be marked for cutting in less than five min. The standard size marker is for pipe ranging from 1½ in. to 18 in. in diameter. A larger size is for pipe 16 in. to 48 in. in diameter.

Manufacturer—Contour Marker Corp., Compton, Calif.



KATHABAR HUMIDITY CONDITIONING CUTS BAR-COOLING TIME 98.7%

with continuous frost-free air at 0°F



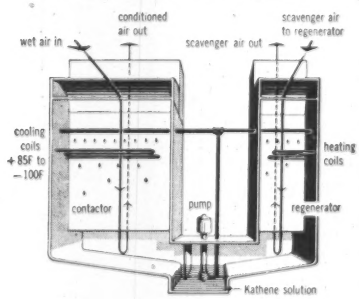
There's no excuse for letting the weather put the brakes on candy production. Here's proof: one of the world's largest candy makers has cut bar-cooling time *from 16 hours to 12 minutes* with a continuous process and sub-freezing, frost-free air, all year 'round. They decided what they wanted the process to do; they achieved it with Kathabar humidity conditioning.

Kathabar units, teamed with refrigeration, supply air at 0°F and 2 grains/lb. to 8 cooling tunnels. With the Kathabar system to remove moisture that causes frost and condensation, refrigeration handles the cooling load with minimum power consumption, maximum efficiency. Duplicate coils, once required to operate during defrosting, are eliminated along with the frost.

The Kathabar units operate continuously and automatically, without dual batteries or storage space for bulky dry desiccants, and without carryover of the chemical absorbent into conditioned spaces.

In addition to cooling, candy manufacturers have profitably applied Kathabar equipment to many other processes, such as drying, polishing, coating, bottoming, packaging, storage, and employee comfort. Whether your operations are batch or continuous, large or small, it will pay you to learn what Kathabar humidity conditioning can do to help you make better candy at any time, at lower cost. Send for Literature Group K-54-7.

WHAT COULD BE SIMPLER?



Air to be conditioned passes through the contactor, where an absorbent solution removes moisture (the amount depends on the automatically-controlled temperature of the solution). In the automatic regeneration, about 15% of he soution is heated, and the moisture it releases is blown out the window.

Kathabar®
HUMIDITY CONDITIONING

SURFACE COMBUSTION CORPORATION · TOLEDO 1, OHIO

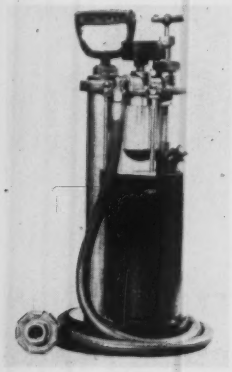
ALSO MAKERS OF *Surface* INDUSTRIAL FURNACES *Janitrol* AUTOMATIC SPACE HEATING

EQUIPMENT DEVELOPMENTS

Continued

Leak Detector for Pressure, Vacuum

"Dragnet" leak detector used for testing piping for gas, steam, water, oil, refrigerants, air and other pressure or vacuum systems. . . .The unit is portable and consists of a test pump, air storage tank, pressure gage, transparent bubble bowl

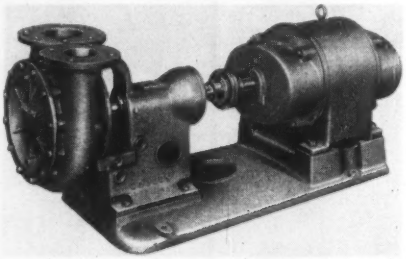


with non-freezing fluid, and a flexible hose for connecting to piping under test. After the piping is pumped with air to the desired pressure, the bypass valve is closed so that any air entering the pipe from the storage tank flows through the bubble bowl. Any leak in the piping brings air from the storage tank through the dip tube in the bubble bowl causing the liquid to bubble. The company states that the test can be made in 10 or 15 min.

Manufacturer—Universal Controls Corp., 731 W. Davis St., Dallas.

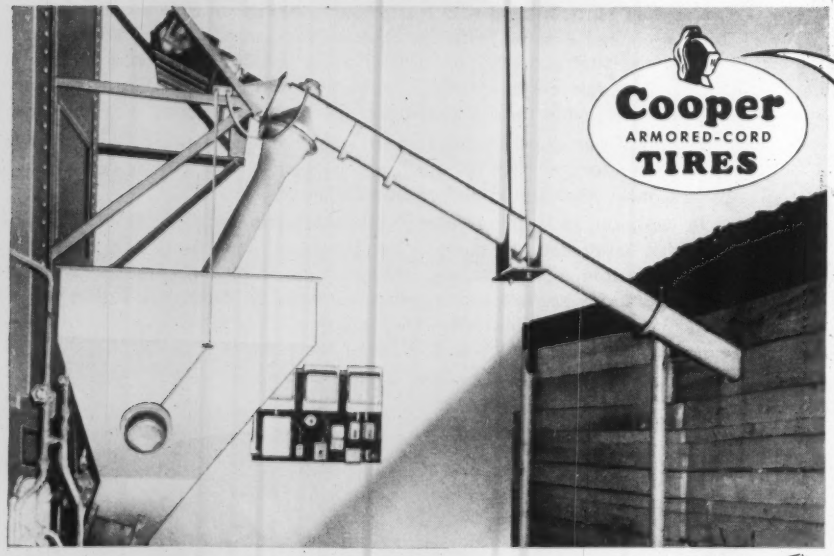
Centrifugal Pump for Corrosive Liquids

New line of centrifugal pumps designed for handling corrosive liquids and slurries. . . . The "Fig. 3715" pumps are available in several alloys and in nine sizes, providing capacities to 720 gpm and heads to 200 ft. They are of support-head



construction with the support cast integral with the bearing housing. Cooling of support head and quenching of the gland make it possible to handle liquids up to 350 F, the manufacturer states. The stuffing box is on the suction side of the impeller. Suction and discharge connections are in the casing. The impeller is of the semi-open type and is statically and hydrau-

SWITCHING TO AUTOMATIC COAL HANDLING, COOPER TIRE AND RUBBER



"TAKES IT UP A FLO-TUBE"

. . . We are very pleased with the FLO-TUBE operation. To date we have put some 10,000 tons of coal through it without maintenance.

Very truly yours,
COOPER TIRE & RUBBER COMPANY
Mil McKinley, Chief Engineer

This shows how easily CANTON'S FLO-TUBE can be adapted to existing coal fired equipment. Available in Heavy Cast Iron U-Trough design for permanence, or Steel U-Trough or Round Pipe types for economy. Direct Drive through Geared Motor reduces H.P. required and operating costs—also assures dependability and low upkeep. Also can be had in completely dustproof "package-unit" type combined with Canton Ramfeed and Screwfeed Stokers.

Exposed end placed in Coal Bin picks up coal and fills Hoppers automatically. Can be applied on incline or horizontally to feed one or a series of Hoppers. Bin Level Controls keep Hoppers filled to desired height at all times. Alarms or Lights can be applied to signal fuel supply failure. U-Trough design permits instant accessibility to all parts.

WRITE FOR THIS BROCHURE

CANTON STOKERS

CANTON STOKER CORPORATION

SPECIALISTS IN AUTOMATIC COAL FIRING, HANDLING AND CONTROL EQUIPMENT

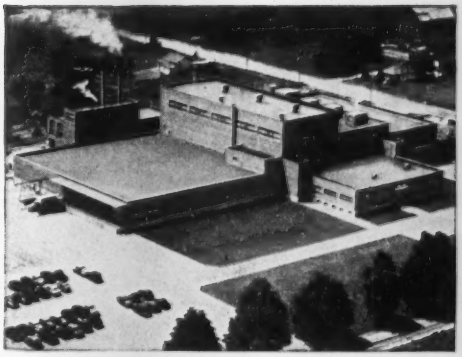
2400 Andrew Place S. W.
CANTON, OHIO

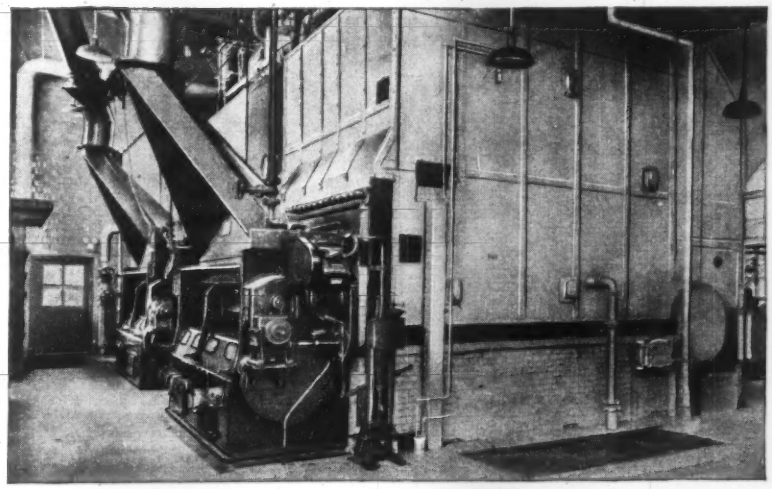
CANTON STOKER REPRESENTATIVES IN ALL PRINCIPAL CITIES WILL BE HAPPY TO GIVE YOU COMPLETE INFORMATION AND PRICES . . . OR WRITE DIRECT

"COAL'S BEST FOR OUR MODERN PLANT!

It's low in cost . . . It's clean and convenient!"

says G. W. Peters, Engineering Manager
M&R DIETETIC LABORATORIES, INC.
makers of PREAM & SIMILAC





"We made a careful study of fuels and burning equipment before building our modern new plant in Sturgis, Michigan. This plant was designed to produce baby food. So the steam plant has to be clean and dust-free as well as economical to operate. Also, we wanted a fuel we could store safely and easily in order to insure ourselves against any shortages.

"We decided on bituminous coal—and the up-to-date installation shown here. It certainly fills the bill on every count. Our modern combustion equipment makes coal far more economical than any other fuel. Up-to-date coal and ash handling give us convenient operation completely free of dust nuisance."

Additional case histories, showing how other types of plants have saved money by burning coal the modern way, are available upon request.

Discover for yourself the great advantages of coal burned the modern way. Call in a consulting engineer. He'll show you how today's combustion equipment can give you 10% to 40% more power from a ton of bituminous coal than from equipment used only a few years ago. He'll show you how modern labor-saving coal and ash-handling equipment make a coal-fired installation clean, convenient, and dust-free.

If you plan to remodel or build a new plant, be sure to look into the low cost and convenience of bituminous coal. Consider coal's other advantages, too. It has reserves that are virtually inexhaustible. America's bituminous coal mining industry is the most efficient and productive in the world. With bituminous coal, you can be sure of plenty of fuel at relatively stable prices now and for years to come.

If you operate a steam plant, you can't afford to ignore these facts!

BITUMINOUS COAL in most places is today's lowest-cost fuel, and coal reserves in America are adequate for *hundreds of years to come.*

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

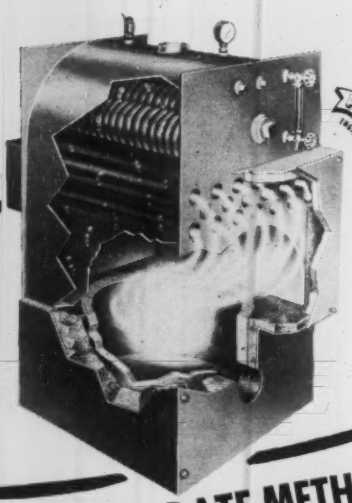
COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE
A Department of National Coal Association, Southern Building, Washington 5, D.C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!



MOST UP-TO-DATE METHOD OF SATISFYING VOLUME HOT WATER REQUIREMENTS

in...
apartment houses, restaurants, hotels, hospitals, office buildings, schools, factories, processing plants, etc.

WH SERIES
Oil or Gas Fired

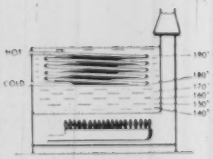
9 Sizes—350,000 to 1,650,000 BTU/hr.
Hot Water Delivery: 300 to 5,000 G.P.H.

A.S.M.E. APPROVED

PORTMAR Twin Coil Volume Water Heater Eliminates the Storage Tank!

★ ***Instantaneously and automatically delivers large quantities of sanitary hot water through copper coils.***

Here's a clean, compact, low-cost installation that operates with exceptional economy . . . reduces high maintenance, utilizes valuable space. The heater's fast hot water circulation makes the unit self-cleaning, causes quick temperature pickup, needs no recovery time. Supplies two temperature hot water: 140° for general use; 180° for sterilizer-rinse.



ADVANTAGES OF THE INDIRECT (TANKLESS) HOT WATER SYSTEM

Protected by free-circulation water, the submerged twin coils never come in contact with intense burner heat, which of course, shortens the life of direct systems. In indirect systems, the coils are the highest point in the water heater circuit. The hottest water rises as it is heated, transferring heat to the twin coils. Water flowing through the coils is instantly heated for immediate use.

Write for literature and prices

Portmar Boiler Company Inc.
493 Seventh Street, Brooklyn 15, N. Y.
Residential, Commercial, Industrial Water Heaters and Heating Boilers, Vertical, Horizontal Tubular Boilers • Rotary Flame Boilers

EQUIPMENT DEVELOPMENTS

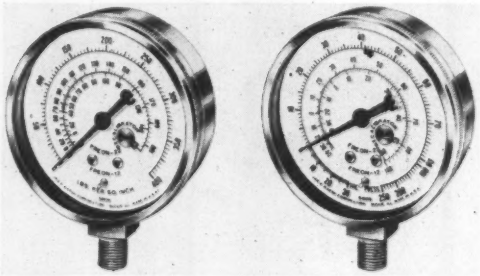
Continued

lically balanced. Standard bearings are grease lubricated and grease relief is provided to prevent over lubrication.

Manufacturer—Goulds Pumps, Inc., Dept. HP, Falls St., Seneca Falls, N.Y.

Testing Gage for Refrigeration Systems

Gage set for testing "Freon" refrigeration systems. . . .The set consists of two 2½ in. dial sizes gages; one graduated 0-400 psi, and the other a compound retard gage graduated 30 in. by 250 psi. Dials on both gages are provided with cor-

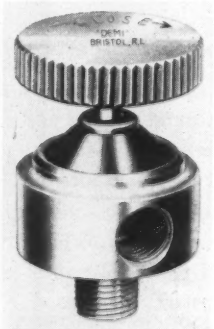


responding temperature scales for "Freon 12" and "Freon 22". Both gages are made with heavy duty bronze bushed movements and are equipped with the company's "Recalibrator".

Manufacturer—Jas. P. Marsh Corp., Skokie, Ill.

Packless Angle Valve

Packless "Demi Model AM" angle valve with male inlet connection and female outlet connection. . . . The valve can be equipped with panel mount bonnets, tee handles or round handles, toggle actuated, or with diaphragm operators for remote control. In brass or aluminum, the valve is rated for

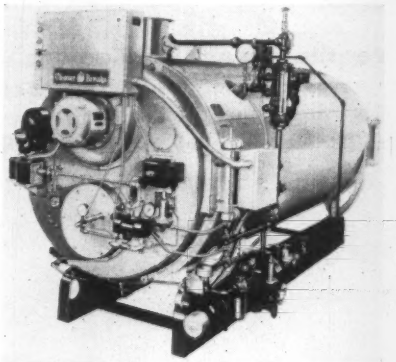


vacuum or 750 psi. In steel or stainless steel it is rated for vacuum or 1500 psi. The valve is normally supplied with an integral seat, "SS" diaphragm and "Teflon" gasket. A neoprene diaphragm can be furnished for 300 psi service.

Manufacturer—G. W. Dahl, Bristol, R. I.

New Horsepower Capacities for Boilers

Extension of line of "CB" boilers to include units of 50, 60, 70 and 80 boiler horsepower capacity for installations requiring steam or hot water boilers for processing or heating. . . .Models are available to handle all grades of fuel oil or gas. The manufacturer states that a new silent oil pump using

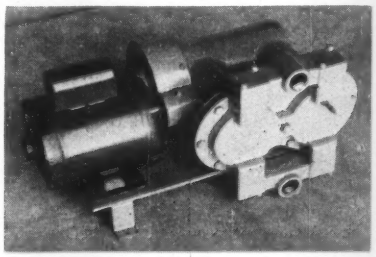


a gear head motor eliminates pump operational noise. Front and rear hinged doors are designed to provide maximum accessibility for operation and maintenance. Burner components are mounted on the front head.

Manufacturer—Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12.

Diaphragm Pump

"Model 80-50" designed for pumping abrasive liquids, petroleum, liquid food products and chemicals. . . .All liquids are isolated from the working system of the pump, and it is said to be leakproof because of the elimination of seals and

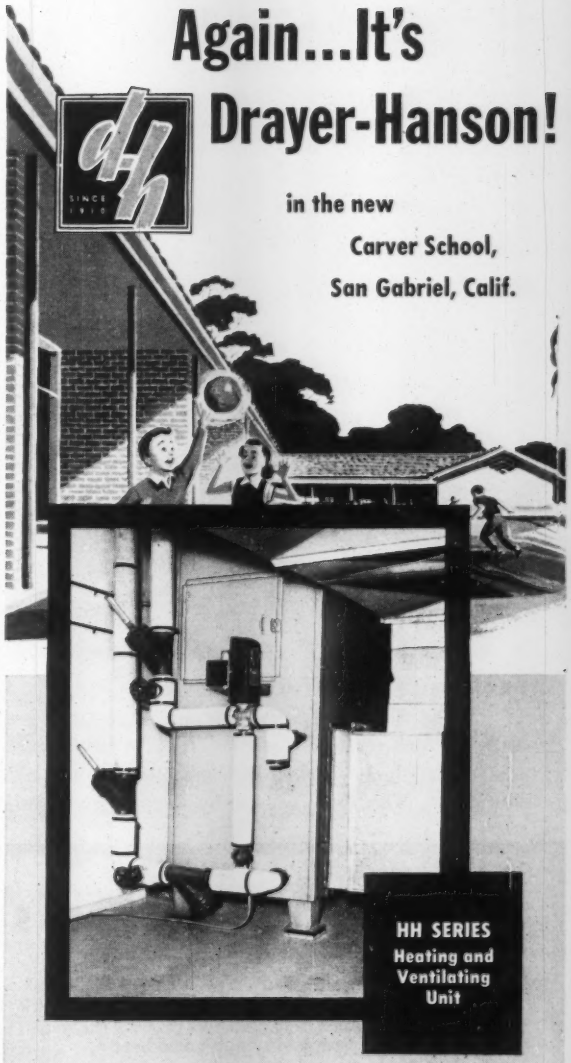


packing glands. Pump capacity at 50 lb head pressure is 700 gph and pump speed is 483 rpm. The pump drive operates in an oil bath and is hermetically sealed from the pumping chamber. The motor is a ½ hp, single phase, a-c capacitor start type.

Manufacturer—The Perry Co., P.O. Box 2057, Waco, Texas.

Panel Mounted Vacuum Gage

Vacuum gage for instantaneous measurements of vacuums in the 1 to 1000 microns Hg range . . . .The panel mounted instrument, which



In important installations everywhere ...units like this are giving the dependable, long-lived service which keynotes Drayer-Hanson products.

When your prospects say, "year-'round air conditioners," *compare,* feature by feature. You're bound to specify D-H!

With HH's, you can choose your arrangement: horizontal (HH), or vertical (HHV) units. 13 sizes, to 28,000 CFM. Coils for water, steam, direct expansion—or a combination.

You can't mistake them! *The extra features* you find in HH's are solving tough air conditioning problems, the country over.

Investigate! *Full details, request Bulletin C-4.20.*

drayer-hanson
INCORPORATED
3301 MEDFORD STREET, LOS ANGELES 63, CALIFORNIA

EQUIPMENT DEVELOPMENTS

Continued

uses a principle of directly heated thermocouples, is designed for test panels in applications such as vacuum pumping, metal vacuum depositing or with other vacuum processing equipment used in vacuum tube and refrigeration equipment manufacturing. The instrument is 7 in. high, 7½ in. wide, and 2¼ in. deep.

Manufacturer—Hastings Instrument Co., Inc., Hico Instruments Div., Warwick, Va.

Above: Valve
Right: Gage

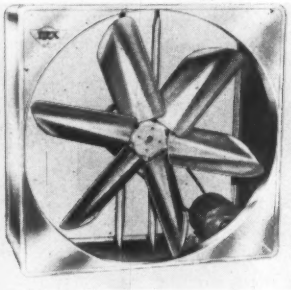
Seal Balanced Angle Valves

Seal balanced angle valves of venturi flow construction designed to provide balanced control at high pressure differentials with tight shutoff. . . .The force caused by line pressure working against the cross sectional area of the plug is cancelled out by means of a drilled hole along the axis of the plug, intersecting radially drilled holes near the top, according to the manufacturer. The line pressure is transmitted through this passage and exerts a downward force on the plug equal to the upward force. Tight shutoff is attained by sealing the pressure in the body bowl from the balancing chamber with a frictionless plastic seal.

Manufacturer—Hammel-Dahl Co., 175 Post Rd., Providence 5, R.I.

Fans for Ventilation and Air Cooling

Four variable-use ventilating fans added to "Rex Airate" line. . . .Blade diameters of the six-bladed fan assemblies range from 24 to 38 in.



and produce from 3850 to 10,000 cfm. The belt driven fans can be supplied for either horizontal or

RIGIDBILT STANDARD STEAM HEATING COILS

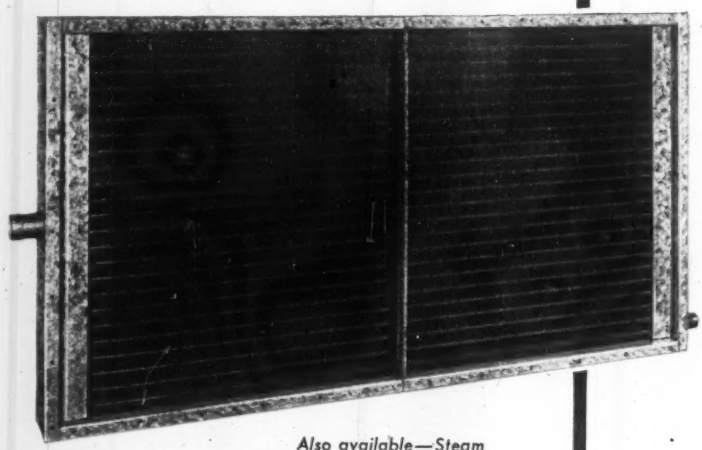
Maximum Heat Transfer Assured!

Complete heat transfer by heavy aluminum fins, heavy galvanized steel casings. Extruded fin collars entirely surround copper tubes. Fully enclosed headers, thus air directed over finned section only. Bolted and punched casings for easy installation. Standard steam coils variable in height and length permit coil selection to your exact needs. Entire coil custom engineered and tested to 300 lbs. air pressure under water.

RIGIDBILT IS BETTER BUILT—Write for Catalog

RIGIDBILT INC.

2852 W. FULTON ST., CHICAGO 12, ILLINOIS



Also available—Steam Distributing Tube Heating Coils.

FAST DELIVERY!

AIR CONDITIONING & VENTILATING UNITS • UNIT & PRODUCT COOLERS • HEATING & COOLING COILS
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

EQUIPMENT DEVELOPMENTS *Continued*

vertical operation. Automatic wall or ceiling shutters, two speed motors, front and rear guards are available as optional accessories.

Manufacturer—Air Controls, Inc., 2310 Superior Ave., Cleveland 14.

Air Filter for Pneumatic Instruments

Air filter designed to prevent dirt, oil, water and other foreign matter from entering pneumatic instruments. . . .The filter consists of a top cap with supply and outlet connections, a chamber with a drain cock at the bottom, a resin impregnated filtering sleeve, and a water baffle. In operation,

supply air enters through the inlet port, strikes a baffle plate on the cap, enters the chamber, passes through the filter and leaves through the outlet port. Filter capacity is 4 cfm of air or natural gas, sump capacity is 12 cu in., filtering area is 21.2 sq in. and maximum working pressure, 150 psi. Supply and outlet connections are ¼ in. NPSF.

Manufacturer—The Foxboro Co., Foxboro, Mass.

EQUIPMENT BRIEFS . . .

POWER RELAY designed to eliminate transmission lags in pneumatic systems. . . . The "Autronic Type P2R" power relay is an electro-pneumatic transducer. It takes the electrical output from the controller or manual control and converts it to an air loading pressure proportional to the electric current. No electric motors, boosters or slide wires are employed.

Manufacturer—The Swartwout Co., 18511 Euclid Ave., Cleveland 12.

DEALKALIZING SALT SPLITTER uses a basic anion exchange resin capable of salt splitting and substituting chloride anions, for bicarbonate, carbonate, sulphate and nitrate radicals. . . . The company states that this process of chloride anion reduces alkalinity without use of acids and reduces CO_2 in steam, and provides continuous treatment under pressure.

Manufacturer—Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia 32.

NEW!

MULTURI

(Multiple Venturi)

GAS BURNER

Especially designed for . . .

HARD-TO-FIRE

● SCOTCH MARINE BOILERS

HARD-TO-FIRE

● STEEL FIRE BOX BOILERS

AT HIGH FIRING RATES AT HIGH EFFICIENCY!

A Premix Type Gas Burner, ideal for commercial and industrial size boilers and warm air furnaces. Gives maximum performance from hard-to-fire Scotch Marine and steel fire box boilers. Flame characteristics make the burner a natural for units with extensive refractory surface. Suitable for any gas at 4" gas pressure or more. Permits high firing rates at high efficiency. Simple to install, adjust, and operate. Completely Factory Wired and Assembled . . .
Ready for Immediate Installation !

MULTURI BURNERS are available in standard modular units of 6 to 54 mixers. Capacities from 1,200,000 to 10,800,000 BTU/hr. Special units of higher capacities can be furnished. *Write or phone us for detailed information.*

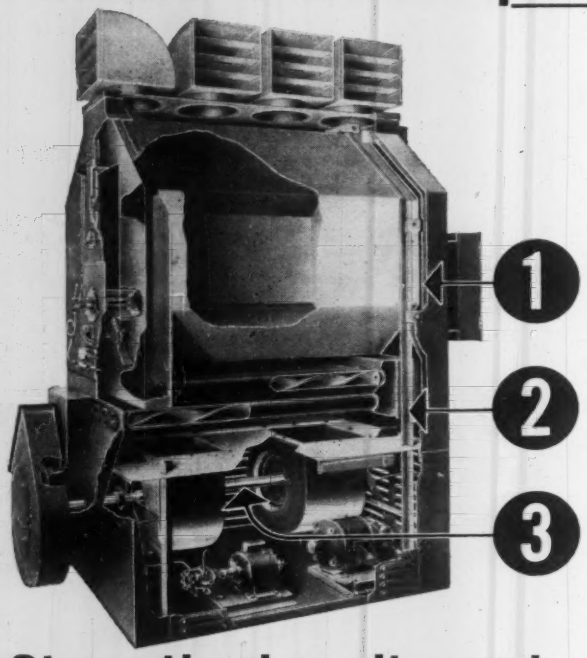
Also Available — Nordensson Power Burners and Combination Gas-Oil Burners.

ROBERTS-GORDON APPLIANCE CORP.

DEPARTMENT HPAC • BUFFALO 6, N. Y.

Conversion Gas Burners • Gas Heating Equipment

another
DRAVO HEATER plus



Strength where it counts

1. Heavy-gauge double outer casing gives double strength . . . air space between provides better insulation, cuts radiation loss to less than 1%.

2. Heavy duty structural steel framework gives more strength to heater . . . permits safe wall-mounting or suspension from ceiling to save floor space.

3. Strong large-diameter fan shaft carries all air supply fans and exhauster . . . reduces number of working parts . . . adds extra life to heaters.

Dravo Heaters are ruggedly constructed . . . and have *extra strength where it counts.* This extra strength, another Dravo Heater PLUS, is your assurance of longer heater life, economical operation, and flexibility of installation.

Mail the coupon for complete information

DRAVO CORPORATION, Heating Department
Fifth and Liberty Avenues, Pittsburgh 22, Penna.

DRAVO

Please send me complete information about the Dravo:

☐ *Counterflo* Space Heater ☐ *Paraflo* Space Heater
☐ *Gas Fired* Unit Heater

☐ Please have a representative call at no obligation to me.
☐ Ask for Bulletin IJ 598-8091.

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

RECENT TRADE LITERATURE...

Air Control Valves

Three types of air control valves are described and illustrated in Bulletin 101B — integral pilot operated, remote controlled, and direct operated. Drawings show how the air flows through the valves and to the operated cylinders. The advantages of each type, an explanation of how they work and a list of available standard models are included.

Manufacturer—Ross Operating Valve Co., Dept. 1403, 120 E. Golden Gate, Detroit 3.

Aluminum Utility Sheet

Folder describes applications, specifications and availability of aluminum utility sheet. Special emphasis is placed on its use for ductwork. Tables show the weight per standard flattened sheet, weight per lineal ft of coil, and weight and coverage of equivalent galvanized gages.

Manufacturer—Kaiser Aluminum & Chemical Corp., 1924 Broadway, Oakland 12, Calif.

Anchoring Devices

Twelve page catalog covers a complete line of anchoring devices and includes dimensions and price lists. Described are devices for anchoring screws or lag screws to plaster, stone, brick, wood or concrete; drives for hard material; tapers for machine screws; hammer sets for machine bolts-thread in; anchors for machine bolts-thread out; toggle bolts for hollow walls; lag shields for standard thread bolts; and drills.

Manufacturer—The Rawlplug Co., 271 Church St., New York 13.

Asphaltic Coatings

Booklet GM-100 describes uses of asphaltic protective coatings other than for rust prevention, including vapor sealing thermal insulation, waterproofing building walls, dampening sound and vibration, controlling condensation and insulating. In addition to a discussion of physical properties, a selection table shows in condensed form various applications, types of material for each application, special features and coverage.

Manufacturer—The Insul-Mastic Corp. of America, 1141 Oliver Bldg., Pittsburgh 22.

Backward Curve Blower

Four page bulletin describes the mechanical and engineering features of a new backward curve blower manufactured in all NAFM sizes from 12½ to 36½ in. It has self limiting horsepower characteristics. Motors are "job matched."

Manufacturer—The Peerless Electric Co., Fan and Blower Div., West Market St., Warren, Ohio.

RECENT TRADE LITERATURE — *Continued*

Baseboard Diffuser

Four page folder presents information on a new extended baseboard perimeter diffuser, including photographs and drawings of the built in mechanical damper, step by step installation drawings and performance data, specifications and prices.

Manufacturer—The Lima Register Co., 651 N. Baxter St., Lima, Ohio.

Boiler Blowdown Control

Boiler Blowdown Control is the title of Technical Paper 128. Principal types of boiler blowdown are discussed as well as various control methods necessary to assure production of pure steam and keeping heat transfer surfaces free of scale and other deposits.

Manufacturer—W. H. & L. D. Betz, Gillingham & Worth Sts., Philadelphia 24.

Clay Pipe for Ducts

Five page bulletin covers special uses of vitrified clay pipe and "Screw-Seal" pipe in industrial duct installations. Described and illustrated are clay pipe installations for waste disposal and heating, ventilating, and air conditioning ducts. The manufacturer states that the pipe is unaffected by the corrosive action of acids, gases and commonly known industrial chemicals.

Manufacturer—The Robinson Clay Product Co., Vitrified Products Div., 65 W. State St., Akron 9, Ohio.

Commercial, Industrial Air Conditioners

Ceiling mounted and floor mounted central station air conditioner units for commercial and industrial applications are covered in Bulletin C-1100-B33B, which is illustrated and gives specifications, dimensions, accessories, physical data and features of each model.

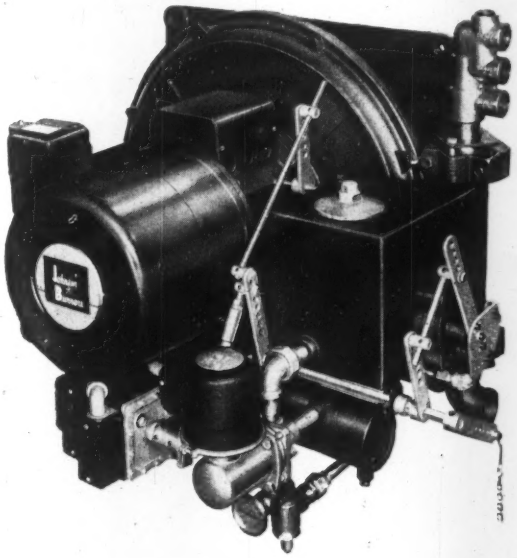
Manufacturer—Worthington Corp., Advertising and Sales Promotion Dept., Harrison and Worthington Sts., Harrison, N.J.

Diaphragm Operated Solenoid Valves

Bulletin M-500 covers the design and performance characteristics of "DO" diaphragm operated solenoid valves. It contains photos, drawings, specifications and tables. Cross section views show open and closed positions of the valve's two moving parts, solenoid plunger and synthetic rubber diaphragm. Other drawings give overall valve dimensions.

Manufacturer—Eclipse Fuel Engineering Co., 1012 Buchanan St., Rockford, Ill.

Now you can have smooth, automatic "Cold Starts" regardless of Temperature and Viscosity variations!



THE REVOLUTIONARY NEW

JOHNSON

MODEL 53

built with a

POSITIVE DISPLACEMENT METERING PUMP

Here, for the first time, is a heavy-duty burner that will give you smooth, sure, automatic starts after shut-downs, when the oil in storage tank and lines is cold and hard to pump. More successfully than ever before, the new Johnson "Fifty-three" has solved the problem of "Cold Starts".

Built with a positive-displacement Metering Pump . . . a 3-Way Magnetic Oil Valve . . . and a high efficiency Suction Pump, the "Fifty-three" will maintain a fixed air-fuel-ratio regardless of variations in oil temperature and viscosity. It will start up and operate automatically on colder oils than any other burner on the market.

It is available in 8 sizes, from 25 HP to 400 HP. It brings you all the efficiency, economy, and fine engineering that have made Johnson Burners famous all over the world. It's surprisingly easy to service, inspect and regulate. All working parts are readily accessible. Make it a point to investigate the performance of this revolutionary new burner. We'll gladly send you full information.

Johnson Oil Burners

Builders of fine Oil Burner Equipment since 1903

S. T. JOHNSON CO.
940 Arlington Ave., Oakland 8, Calif.
Church Road, Bridgeport, Pennsylvania

RECENT TRADE LITERATURE *Continued*

Dust Control in Woodworking

Bulletin No. 995 shows how wood dust can be controlled in woodworking industries with the use of "Dustube," a cloth-tube type collector. Several illustrations describe how specific pieces of woodworking equipment are hooded and how ductwork carries the dust to the collectors.

Manufacturer—American Wheelabrator & Equipment Corp., 1321 S. Byrkit St., Mishawaka, Ind.

Electric Heating Unit for Air Dryer

Catalog HPAC-54 describes the internal heaters used in the "Oriad" dryers manufactured by the C. M. Kemp Co. A description is given of how these heaters provide the controlled heat necessary to supply dry air for air operated instruments. Other electric heaters, applications and engineering data are presented in the catalog.

Manufacturer—Heatube Corp., Allegan, Mich.

Gas Unit Heating

Bulletin SA-541-A, *Application of Gas Unit Heating*, outlines how, why and when to use gas fired unit heaters. Included in the pocket size booklet are hints on heater selection and installation, a schematic diagram explaining how a gas unit heater works, a heating survey outline, instructions for estimating heat loss and computing gas line requirements, and a summary of the advantages of gas unit heating.

Manufacturer—Reznor Mfg. Co., Mercer 8, Pa.

Heat Pumps

Four page folder presents the basic principles of heat pump operation. The use of water as a source of heat for the "Flow-Temp" heat pump is explained, as well as the removal of heat from the interior of a building for comfort in warm weather. Various types of heat pumps are described along with a discussion of the advantages of such systems. Typical installations are shown. A table shows heating and cooling capacities.

Manufacturer—Acme Industries., Inc., Mechanic St., Jackson, Mich.

Mechanical Drive Turbines

Velocity stage class "CA" turbines for mechanical drive are covered in Bulletin 4202. Design features, which are shown on a cutaway drawing, include center line support and flexible front end mounting for radial and axial expansion. One page of features and specifications covers general arrangement of the turbine, principal specifications, materials and standard and optional features. The

Paracoil

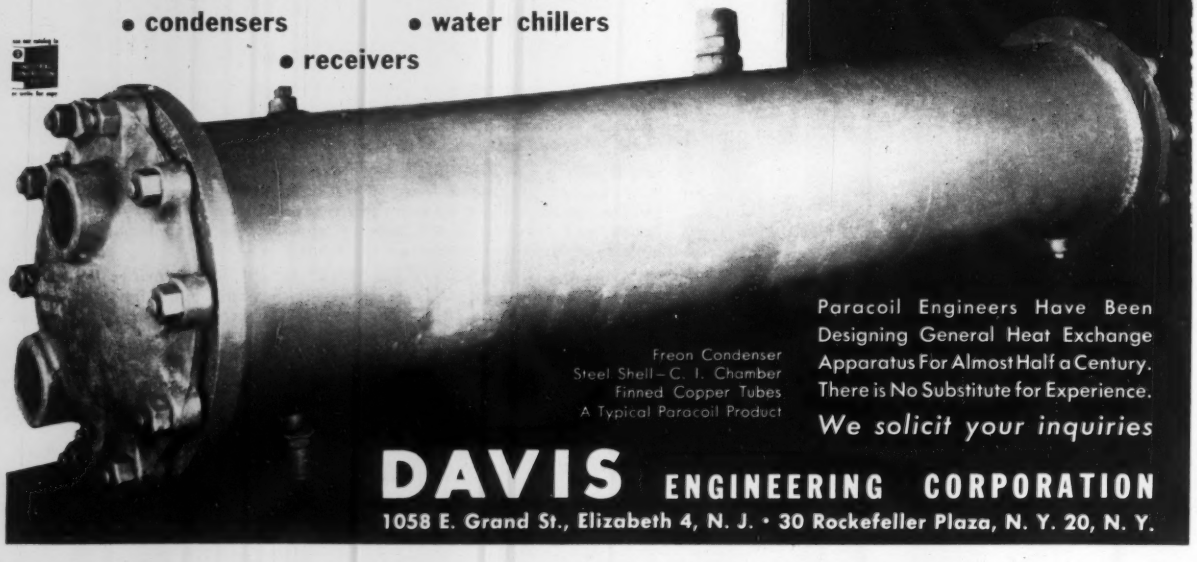
Air Conditioning and Refrigeration Equipment

PARACOIL Units For All Air Conditioning and Refrigeration

- evaporators
- condensers
- receivers
- brine coolers
- water chillers

SPECIAL DESIGNS FOR THE PROCESS INDUSTRIES

- Built for All Commercial Refrigerants
- Finned or Bare Tubes
- Straight or U Type Tubes
- Designed to Any Stationary or Marine Code



Freon Condenser
Steel Shell—C. I. Chamber
Finned Copper Tubes
A Typical Paracoil Product

Paracoil Engineers Have Been Designing General Heat Exchange Apparatus For Almost Half a Century. There is No Substitute for Experience.

We solicit your inquiries

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1058 E. Grand St., Elizabeth 4, N. J. • 30 Rockefeller Plaza, N. Y. 20, N. Y.

RECENT TRADE LITERATURE *Continued*

bulletin also presents line drawings showing the overall dimensions of the turbine and its parts.

Manufacturer—De Laval Steam Turbine Co., Trenton 2, N. J.

Nylon Bearings

Illustrated catalog describes "Nylined" bearings and "Nyliners." The advantages of nylon as a bearing material, especially where bearings must operate without oil lubrication, are explained. In addition, the catalog contains engineering data, installation information and a bearing evaluation chart.

Manufacturer—Thompson Industries, Inc., Manhasset, N.Y.

Packaged Boilers in Hospitals

Bulletin 1223 describes two types of "Powermaster" packaged automatic boilers for steam processing as well as steam and hot water heating service as applied to hospitals. Constructional and operational advantages are described and pictured.

Manufacturer—Orr & Sembower, Inc., Morgantown Rd., Reading, Pa.

Plug Valve Actuators

Bulletin 3020 describes tandem type actuators for valves requiring relatively high torques to operate, and floating bar type actuators for use on valves requiring lower operating torques. The bulletin also shows an actuator selection table, typical applications, dimensions and weights, and various mountings.

Manufacturer—Ledeen Mfg. Co., 1600 So. San Pedro St., Los Angeles 15.

Pneumatic Transmitters

Bulletin No. 170 gives operating details and specifications for a new force balance "Rotameter" float position transmitter for use with pneumatic receivers and control instruments. Schematic diagrams show component parts and applications.

Manufacturer—Brooks Rotameter Co., Lansdale, Pa.

Protective Coatings

Bulletin No. 200, *Polyclad Protective Coatings*, covers five types of vinyls with primer requirements for all types of surfaces, including rusty steel and old coatings. Facts are given on use, temperature limitations, coating thickness and coverage, relative weathering ability and cost.

Manufacturer—Carboline Co. Div., Mullins Non-Ferrous Steel Castings Corp., 331 Thornton Ave., St. Louis 19.

Sprockets and Chains

Bulletin A-632 covers latest technical data and prices on all items in the "Taper-Lock"

WIREMOLD

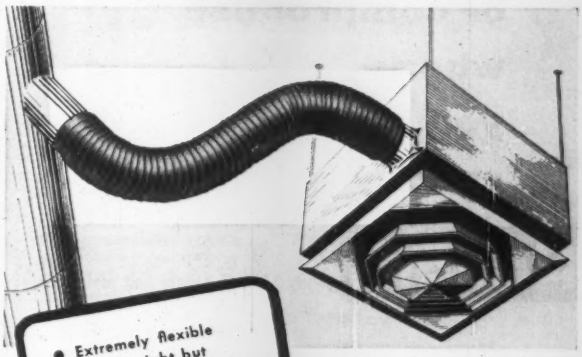
flexible

AIR DUCT

tested-proven-preferred

for Commercial

Air Conditioning systems



- Extremely flexible
- Light weight but sturdily constructed
- Takes all bends without kinking
- Excellent air flow characteristics
- Waterproof . . . flame resistant

Easy to install ... Saves time, money, effort!

WIREMOLD Flexible Air Duct was developed to meet all requirements for flexible connections in air conditioning systems as specified by leading manufacturers of air distribution equipment.

WIREMOLD Flexible Air Duct's exclusive construction and a specially coated Fibreglas fabric assure maximum longevity. Fabric component is *mechanically locked* into the strong, steel spiral — no glue or other adhesive to dry out or crack.

WIREMOLD AIR DUCT for air conditioning applications was developed through two years of laboratory testing; service-proved in many prominent buildings. Recommended by leading makers of air distribution equipment.

Get the complete story on WIREMOLD Flexible AIR DUCT. Write for Data Sheet S-3.

The WIREMOLD Company

HARTFORD 10, CONNECTICUT

No need to improvise or compromise when you specify

AGITAIR

Only AGITAIR square and rectangular air diffusers are custom-made to suit conditions of each application. The patented, built-in diffusing vanes are scientifically arranged in various louver patterns which provide blows in 1, 2, 3 or 4 directions without use of blank-offs. This feature eliminates the necessity of "oversizing" to compensate for blank-offs or baffles.

When you specify AGITAIR square and rectangular diffusers you can be sure of 100% draftless air distribution from any ceiling or sidewall location. What's more, these smart, modern units are now available with or without removable, interchangeable cores. Whatever the space condition, there's an AGITAIR custom-made to give perfect performance and complete satisfaction.

New 34-page Type R Catalog reveals how correct air distribution is simplified by AGITAIR. Contact your local AGITAIR representative, or write us direct for your free copy.

AIR DEVICES INC.
185 Madison Avenue, New York 16, N. Y.

AIR DIFFUSERS • FILTERS • EXHAUSTERS

RECENT TRADE LITERATURE *Continued*

line which now includes sprockets and chains for sizes ranging from 40 through 160. Installation and removal instructions are included. Tabular data contains information on size range, dimensions, number of teeth, sprocket numbers, bushing numbers, weights, bores, keyseats and list prices. One page of the bulletin is devoted to riveted and cottered roller chains and roller chain pin extractors.

Manufacturer—Dodge Mfg. Corp., 500 S. Union St., Mishawaka, Ind.

Stainless Steel Welding Electrodes

Bulletin No. WE-166 deals with the metallurgy of stainless steels, provides a stainless steel electrode selector table and offers tabular material on welding processes as related to varying chemical compositions. Each of the company's welding electrodes available for stainless steel work is described in detail — typical mechanical properties of deposited metal, chemical analysis range of deposited metal, and recommended amperage and voltage range.

Manufacturer—A. O. Smith Corp., Welding Products Div., 3533 N. 27th St., Milwaukee 1.

Steel and Alloy Fabrications

Illustrated catalog shows the manufacturer's line of steel and alloy fabrications. Pictured and described are boilers, heaters, cyclonic separators, breechings, storage tanks, hot water generators, pressure vessels, smoke stacks, transformer tanks and various types of plate fabrications.

Manufacturer—J. J. Finnigan Co., Inc., 455 Means St., N.W., Atlanta, Ga.

Steel Scaffolding

Form KPA-354 shows the operation of the "Speedlock" scaffold assembly lock. Also included is information on sectional scaffolding, rolling towers, hoisting towers, all steel shore, mason's jacks, scaffold jacks and swing stages.

Manufacturer—Waco Mfg. Co., Dept. A, Information Office, 3555 Wooddale Ave., Minneapolis 16.

Thermal Radiometers

Two types of portable radiometers are described in a new leaflet, Form 188. One is designed for total hemispherical thermal radiation measurements, the other for net exchange measurements. Cross section drawings show the design variations between the two types. Curves are included to show response vs. angle of incidence of radiation. Specifications are given covering sensitivity, response time and accuracy.

Manufacturer—Beckman & Whitley, Inc., 1002 E. San Carlos Ave., San Carlos, Calif.

RECENT TRADE LITERATURE *Continued*

Tube Working Tools

Catalog No. 3030 provides a condensed listing of the company's line of tube working tools. Included in the new booklet are descriptions of tools for cutting, flaring, bending, swedging, reaming and pinch-off of tubing. There are also test plugs and tools for refacing flared fittings. Tools for copper, aluminum, steel and stainless steel tubing are shown.

Manufacturer—The Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago 7.

Vapor Degreasing

Vapor Degreasing Do's and Don'ts shows proper operating methods. It covers all phases of metal cleaning through vapor degreasing, including safety, personnel, correct layout and maintenance of equipment, efficient operation, drainage, machines and chemicals. Each phase is illustrated showing the right and wrong methods.

Manufacturer—Manufacturers Processing Co., 1360 Hilton Rd., Detroit 20.

Wrought Iron for Corrosion Protection

The use of wrought iron for corrosion protection in a sewage treatment plant at Port Huron, Mich., is the subject of *Case Study No.* 101. Included in the illustrated four page booklet is a description of the plant, its processing facilities and a technical description of the corrosive services in which wrought iron is used to guard against premature failure.

Manufacturer—A. M. Byers Co., Engineering Service Dept., Clark Bldg., Pittsburgh 22.

Welding Aluminum

Recent developments are described in *Welding Alcoa Aluminum*. In the 176 page book, photographs and drawings are coupled with the text to illustrate the methods of welding aluminum — including torch welding, arc welding, resistance welding and pressure welding. Special attention is given to selection of the welding method, performance of welds, welding aluminum castings and control of welding quality. Tables give information on the physical properties of alloys and strengths of welds.

Published by—Aluminum Co. of America, 733 Alcoa Bldg., Pittsburgh 19.

Welding, Cutting Equipment

Catalog No. 54E describes and illustrates welding and cutting equipment — cutting torches and tips, welding torches and attachments, welding tips, adaptors, regulators and combination outfits. Each is illustrated and its special features and specifications are described.

Manufacturer—The K-G Equipment Co., P. O. Box 538, Allentown, Pa., Att: Karl H. Schmuldt, Gen. Mgr.

AGITAIR

For correct air distribution to suit any space condition, AGITAIR square and rectangular diffusers have no equal. Custom-designed with built-in diffusing vanes, in a wide variety of louver patterns, they provide blows in 1, 2, 3 or 4 directions without use of blank-offs. AGITAIR diffusers need not be centrally located in the area to be served.

Advantages of AGITAIR'S exclusive air pattern control feature are greater design freedom for achitects and engineers, certified 100% draftless air distribution from any ceiling or sidewall location, maximum economy in duct runs.

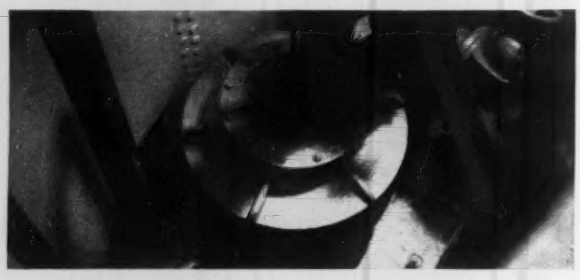
New 34-page Type R Catalog reveals how correct air distribution is simplified by AGITAIR. Contact your local AGITAIR representative, or write us direct for your free copy.

AIR DEVICES INC.
185 Madison Avenue, New York 16, N. Y.

AIR DIFFUSERS • FILTERS • EXHAUSTERS

B R I E F S

from The YEOMANS GUARD



ideal for a small building — PACKEX sewage ejector

This happy combination of guaranteed dependability and low price competitive with that of a good centrifugal pump, makes the PACKEX* pneumatic sewage ejector ideal for small buildings — a school, store, apartment building, factory: any unit with a maximum of 30 fixture units.

In this "economy package" you get the matchless reliability characteristic of all Yeomans pneumatic ejectors — including the famous Shone®Ejector. You get solid assurance of Yeomans engineering service that begins with the installation.

It's a complete unit, with air compressor, electrical equipment, all fittings — ready to install.

You'll find the PACKEX leaflet 4420 helpful — sent on request.

*A Yeomans Trademark
®Registered Trademark

Life Span Unknown — the SHONE® Pneumatic EJECTOR

That's an odd and challenging statement to make about any mechanical device, yet it's the exact truth: nobody knows how long a Shone Ejector will last because not one has ever worn out in service. The first Shone installed in the U. S. — a duplex, in 1899, in the Auditorium Hotel and Theater, Chicago, now Roosevelt College — is still operating quietly, rhythmically, with efficiency unimpaired.

Shone units most commonly recommended for municipal, building and industrial installations are the mechanically controlled type, for these reasons:

- dependability . . . . unequalled
- convenience and accessibility . . . . difficult to find any way to simplify or improve; there's been no important change in principle, basic design or construction since the Shone was invented
- full range . . . . three types to fit different physical specifications

For all problems of pumping a limited gallonage of solids-carrying liquids, the Shone is known throughout the world as the ideal solution — simple, automatic, dependable and completely sanitary.

Impressed? — send for Bulletin 4000-CI

® Registered Trade Name

Yeomans Pumps are Better because of LUBRI-VAC*

Anyone can build vertical centrifugal pumps, and many do. There's no valid reason why they shouldn't be good pumps — and the fact is, most of 'em are. But the pay-off comes in *how long the pump stays in operation — how soon the main bearing has to be replaced.*

So here's the pitch:

- Yeomans Vertical Wet Pit Centrifugals are *better pumps* — will stay on the job longer, without bearing failure — than any similar pumps you can name.

Lubri-Vac is a Yeoman development — a system of lubrication, remarkable in its simplicity, that *keeps the bearing properly lubricated.* Field data proves that Lubri-Vac has reduced bearing failures by an astonishing 95 per cent.

Two Models: • Series 3000 — Heavy Duty Bilge Pump • Series 8000 — Screenless Ejector

Send for Bulletin 3-8000

*Lubri-Vac — A Yeomans Trade Name

YEOMANS BROTHERS COMPANY

2000-5 N. Ruby St., Melrose Park (Chicago), Illinois

WE HEAR THAT . . .

▸ *L. J. WING MFG. CO.*, of Linden, N. J., maker of heating, ventilating and combustion equipment and steam turbines, is celebrating its 75th year in business. The firm was founded in 1879 by L. J. Wing, an inventor who built steam engines, gas generators, marine and stationary gas engines and whose pioneering work is responsible for much of the present day developments in the heating and ventilating fields.

Mr. Wing's work just before the turn of the century centered around the development and construction of propeller disc fans which were driven by pulleys and then by individual steam engines.

In 1905, the firm introduced an individual steam turbine driven fan to furnish forced draft for boiler furnaces. The blower also represented the first development of the propeller type fan for delivery of air against high static pressure.

During World War I, the Wing Co., through the efforts of its present president, Harry S. Wheller, introduced the use of the modern pressure type propeller fan to the U.S. Navy and the first installation was made on the U. S. S. Kimberley. These fans now are known as axial flow fans.

In 1920 the company introduced the overhead suspended and downward discharge unit heater. Its inventor, H. S. Wheller, also was responsible for the addition of the revolving discharge outlet.

The present officers of the company are *HARRY S. WHELLER*, president and general manager, *WALTER W. WILSON*, vice president and treasurer, and *CHARLES H. SMITH*, vice president and secretary. Mr. Wheller joined the firm in 1902.

Wing products are now sold throughout the world through more than 70 sales offices. The company has the distinction of having originated and pioneered everything that it manufactures.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.* has won two awards for product literature in an annual competition sponsored by the Producers' Council, Inc. and the American Institute of Architects.

▸ *SHEFFIELD STEEL CORP.*, a wholly owned subsidiary of *ARMCO STEEL CORP.*, has been consolidated with Armco. No changes have been made in personnel.

▸ A new 15,000 sq ft plant now is being completed at 2270 Noblestown Rd., Pittsburgh, by the *FOXBORO CO.* Assembly, service, repair departments and sales offices will occupy the new building.

▸ *WHITE-RODGERS LTD.*, which started Canadian manufacturing operations last October, has enlarged

WE HEAR THAT

Continued

its production facilities to increase the output of room thermostats, fan and limit controls and oil burner primary controls. Factory and head offices are at 611 Gerrard St. East, Toronto, Ont.

▶ *PENN CONTROLS, INC.* is planning a new engineering and research building to be erected on the site of the present main office and plant in Goshen, Ind. The building will house engineering offices, library, drafting room, laboratory and model shop. It will be air conditioned throughout.

▶ A new booklet, *There's Money in the Air*, designed for *CHRYSLER AIRTEMP* sales personnel, has received one of 14 certificates of award presented by the Chicago Society of Typographical Arts in conjunction with the group's 27th annual exhibition of design in printing.

▶ *THOMAS W. PANGBORN*, one of the founders of the *PANGBORN CORP.* has made a grant of $50,000 to the American Foundrymen's Society, international technical association of the foundry industry. The grant is to be used for scholarships and will be administered through local chapters of the society.

▶ *GENERAL ELECTRIC CO.* recently released a 25 min. color motion picture showing a plan for getting the most productivity out of existing facilities. The film, *Productive Maintenance*, is being used in conjunction with a series of forums sponsored by the company's Apparatus Sales Div.

▶ *WHEELING STEEL CORP.* will construct a second continuous galvanizing line for the production of galvanized sheets and strips. This second line will be at the factory in Martins Ferry, Ohio, where the first line was put into production in 1953.

▶ Erection of the steel framework for *WESTINGHOUSE ELECTRIC CORP.'s* new air conditioning plant at Staunton, Va. is completed. Small and medium sized air conditioning units will be manufactured at Staunton. Completion of the plant is scheduled for late summer.

▶ New officers of the *NATIONAL ASSOCIATION OF FAN MANUFACTURERS* are president, *R. W. NELSON*, a vice president of American Air Filter, Inc.; vice president, *C. C. CHEYNEY*, a vice president of Buffalo Forge Co.; honorary vice president, *J. M. BIRKENSTOCK*, general manager of the Green Fuel Economizer Co., Inc., and secretary-treasurer, *G. W. McCORMICK, JR.*

A NEW more reliable air conditioning method

Assembling Electronic Parts

with exact moisture control

FOR YOUR PROCESS OR PROTECTION

FOR TESTING PRODUCTS OR MATERIALS AT ANY TIME OF THE YEAR

Packaging Food Products

Drying Industrial Material

● This Niagara "Controlled Humidity" method gives you the **MOST EFFECTIVE** Air Conditioning because its cooling and heating functions are made completely separate from adding or taking away moisture. This assures you always a precise result. No moisture sensitive instruments are needed.

MOST FLEXIBLE. You can reach and hold any condition in response to instrument settings, or vary it as you wish.

EASIEST TO TAKE CARE OF. The machine is accessible, the control circuits are simple and easy to operate, and there are no solids, salts or solutions to be handled.

MOST COMPACT. It does a very large amount of work in a small space.

INEXPENSIVE TO OPERATE. At normal atmospheric temperatures (unlike systems that use refrigeration to dehumidify) it needs no summer re-heat.

Write for Bulletins 112 and 122

NIAGARA BLOWER COMPANY

Dept. HP, 405 Lexington Ave. New York 17, N. Y.

Niagara District Engineers in Principal Cities of U.S. and Canada

WHO'S WHAT . . .

▶ *ROBERT GEOCARIS* has joined the sales staff of the Multi-Vent Div., *PYLE-NATIONAL CO.*

▶ *ARTHUR JOHNSON* has been named president of the Air Conditioning Club at *CALIFORNIA STATE POLYTECHNIC COLLEGE.*

▶ *WARREN H. BRAND* is the new director of engineering and research at *CONOFLOW CORP.* He had been with the Atomic Energy Commission.

▶ The board of directors of the *LINCOLN ELECTRIC CO.* has elected *WILLIAM IRRGANG* president and general manager of the company. *JAMES F. LINCOLN*, elected chairman of the board, will remain active in the direction of company policies. *JOHN C. LINCOLN*, founder of the company, was elected honorary chairman of the board and treasurer. Other officers elected were *JOHN S. ROSCOE*, executive vice president; *A. F. DAVIS*, vice president and secretary; *GEORGE LANDIS*, vice president.

▶ *WILLIAM PENN POWERS*, grandson of the founder of *POWERS REGULATOR CO.*, has been promoted to manager of the Los Angeles office. *WILMER L. WALSTAD* has been named manager of the Tulsa office.

▶ *JOHN G. KEARNS* has been elected vice president in charge of the General Div. of *YORK-SHIPLEY, INC.* He will direct sales of automatic heating equipment and air conditioners to large building projects and in export markets.

▶ *AUSTIN E. FRIBANCE* has been appointed chief engineer of the *ROCHESTER MFG. CO.* and will have charge of product design, research and development.

▶ *A. W. PLIER* was re-elected president and general manager of the *D. J. MURRAY MFG. CO.* at a recent meeting of the board of directors. Other officers elected are *M. P. McCULLOUGH* and *D. C. EVEREST*, vice presidents; *W. A. MARQUARDT*, secretary; *G. L. RUDER*, treasurer; *P. W. HOEPER*, assistant secretary and *FRED C. BOYCE*, assistant treasurer.

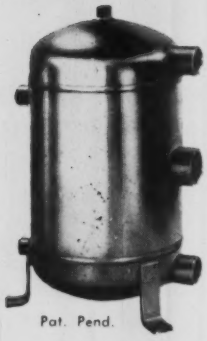
▶ *ROBERT L. FIELDING* is the new president and treasurer of *COMMERCIAL FILTERS CORP.*

▶ *PAUL H. WILSON*, formerly superintendent of the Ambridge plant rolling mill of *A. M. BYERS CO.*,

STANDARD Condensers

WATER COOLED

Standard manufactures a complete line of shell and coil, shell and tube and counterflow condensers together with a complete line of liquid receivers. Write for Catalog #5154.

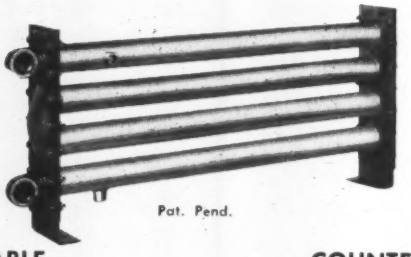


Pat. Pend.

VERTICAL CONDENSERS

Specifically designed to meet the demand where space is limited. Efficient with either city or water tower service. High B.T.U. capacities and low water pressure drops.

MODEL KX



Pat. Pend.

CLEANABLE COUNTERFLOW

Constructed with multiple finned copper water tubes. Features low water and refrigerant pressure drops. Effective for hot climates. For city service or tower usages.

Write for our Catalog #5154 today!

STANDARD REFRIGERATION CO.

3541 West Fillmore Street • Chicago 24, Illinois

WHO'S WHAT

Continued

now is general superintendent of the plant. He succeeds *H. B. LINDERMAN*, who retired recently.

▶ *FRED W. BELZ*, executive vice president of the *WALWORTH CO.*, has been elected chief executive officer of the company and chairman of the executive committee. *ALFRED J. EICHLER* resigned as president and has been elected chairman of the board of directors.

▶ Three new vice presidents of *LAU BLOWER CO.* are *SAMUEL J. HIPPLE*, vice president of special assignments; *WILLIAM E. PRATHER*, vice president in charge of production; and *HAROLD E. NEMECEK*, vice president of purchasing.

▶ *JAMES W. HOSLER*, manager of the merchandise department of the American Blower Corp., has been elected vice president of the *INDUSTRIAL UNIT HEATER ASSOCIATION*.

▶ *DAVID M. FAIRBAIRN*, secretary-controller of *C. A. DUNHAM CO.*, has been elected vice president-controller of the corporation. He will help set and direct the company's fiscal policies, manufacturing and engineering activities.

▶ *ROBERT A. LAWDER*, of the Minneapolis-Honeywell Regulator Co., has been re-elected president of the *NEW YORK SALES MANAGERS CLUB*.

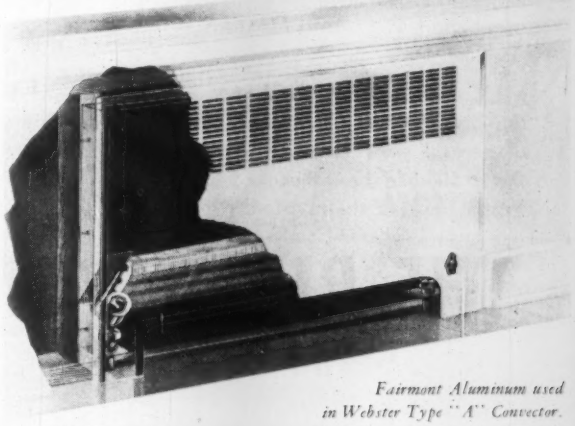
▶ *R. H. MORSE, III* is the new assistant to the vice president in charge of sales of *FAIRBANKS, MORSE & CO.* and will headquarter in Chicago. Succeeding him as general manager of the plant in Beloit, Wis. is *W. E. WATSON*.

▶ *R. A. CARLSON*, formerly chief engineer and sales engineer, has been named vice president and manager of engineering for the *ROCKFORD CLUTCH DIV.* of *BORG-WARNER CORP. E. R. WILLIAMS*, assistant sales manager, has been promoted to sales manager, with *F. C. FAGER* becoming assistant manager. *E. C. SHIELDS* has retired as vice president and general sales manager of the division.

▶ In a series of organizational changes at the Norwood works of the *ALLIS-CHALMERS MFG. CO.*, *THOMAS C. KNUDSEN*, formerly manager of the "Texrope" drive section, has been appointed assistant to the general manager in charge of the mechanical product development laboratory. *VERNON B. HON-*

Better Yet,

USE FAIRMONT aluminum



Fairmont Aluminum used in Webster Type "A" Convector.

In convector heating surfaces, and in all better parts and accessories for heating and cooling applications, Fairmont 2S, 3S and 52S wrought aluminum sheet is nationally recognized for highest quality and uniformity. Improved appearance, high thermal conductivity, light weight, wear-resistant ductility, and non-corrosive and stainproof surfaces—all these objectives and more are readily achieved.

Fairmont bright aluminum rolling mill products—sheet, coil and circles, are now available for prompt delivery to meet manufacturing schedules.

FALCO

FAIRMONT ALUMINUM COMPANY

Fairmont, West Virginia

WHO'S WHAT

Continued

SINGER, formerly engineer in charge, research laboratory, has been named assistant to the general manager in charge of the electrical product development laboratory. *DWIGHT H. LORY*, formerly assistant manager of the "Texrope" drive section, was appointed manager of that section.

▶ *GRAHAM B. BROWN* has been appointed works manager of the *TUBE REDUCING CORP.* Before joining the firm in 1951, he was iron and steel advisor to the Munitions Board, Office of the Secretary of Defense.

▶ Officers recently elected by the *MICHIGAN ENGINEERING SOCIETY* are *JOSEPH B. JEWELL*, president; *SAMUEL D. PORTER*, vice president; *M. E. MALONE*, secretary; *D. BRADFORD APTED*, treasurer; and *GEORGE M. FOSTER*, director at large.

▶ *WARREN HENDRICKSEN* has been named by the *A. O. SMITH CORP.* to fill the newly created post of general sales manager of its Process Equipment Div. He had been head of sales for the Pressure Vessel Dept. of the division.

▶ *W. H. PENDER* now is manager of belting sales for the *QUAKER RUBBER CORP., DIV. of H. K. PORTER CO., INC.*

▶ *RALPH A. PATTERSON*, general sales manager for *BELL & GOSSETT CO.*, has been promoted to vice president. He will establish a branch office in New York City.

▶ *HAROLD R. FOSNOT* has been appointed sales manager of *GRAVER WATER CONDITIONING CO.*, a division of Graver Tank & Mfg. Co., Inc. *LEONARD LIMON* was named manager of the Industrial Boiler Feed Dept.

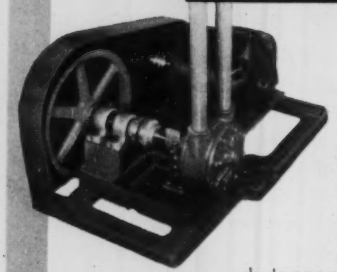
▶ *EDGAR A. BURT* has been appointed chief engineer of *ORR & SEMBOWER, INC.*

▶ *HARVEY WILSON*, office sales supervisor of the Expansion Joints Div. of *FLEXONICS CORP.*, has been promoted to the position of field sales engineer. *WALTER KEIPPER* of the office sales staff was named to the position formerly held by Mr. Wilson.

▶ *WILLIAM E. RICHARDS* has been named manager of staff employment of the *TRANE CO.* He will

THE RIGHT PUMP FOR THE JOB

TUTHILL TYPE SU for Industrial Heating



Designed to handle heavy fuel oils, the Tuthill Type SU multiple V-belt unit provides flexibility never before available. Typical advancements include one-point belt-tension adjustment; motors up to 5 h.p. mounted for easy adjustment or replacement without drilling or tapping; jack shaft supported by ball-bearing pillow blocks, carries weight of pulley and absorbs belt tension. For the complete story, write for Catalog No. 107.

TUTHILL 30A5G FUELSTAT for Domestic Burners

For original equipment or replacement, Model 30A5G FUELSTAT offers many important advantages beyond traditional Tuthill quiet operation, leakfree performance and low power consumption. It is reversible in the field. It has a one-position vertical valve that can be piped from either side and serviced easily. Its mechanical seal is replaceable in the field. It is universally interchangeable with standard commercial models. It reduces pump inventory because the same pump can be used for both rotations and both valve positions. Write for Model 30A5G bulletin.

TUTHILL PUMPS FOR THE PURPOSE

TUTHILL PUMP COMPANY

Dependable Pumps since 1927

939 East 95th Street, Chicago 19, Illinois

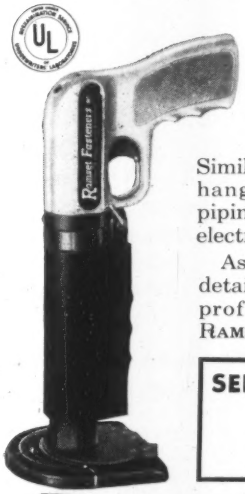
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

Ramset SAVES $11,000

for Fastening Air Ducts in Texas' Largest Store

More than two miles of air conditioning ducts were installed with RAMSET SYSTEM in the new addition to Joske's Department Store at San Antonio, Texas, the "largest store in the largest state."

By using RAMSET Jobmaster, anchoring studs were set at the rate of better than 1 per minute, instead of an estimated 15 minutes each by old-fashioned, conventional methods. Substantial cost savings were thus gained, as well as a far faster, completely secure installation. Similar results were obtained for hanging 13 miles of sprinkler piping and anchoring 43 miles of electric conduit.



Ask your dealer or write us for details on how you can make more profit from every job by using RAMSET SYSTEM.

SEE US AT WASHINGTON
IN BOOTH 147
N. A. P. C. SHOW
MAY 10 TO 13

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.
12109 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING AN Olin PRODUCT

ONLY ELECTROMODE ALL ELECTRIC HEATERS have all 3

Triple Assurance With . . .

HEAT

Where You Need It!

- HARD-TO-HEAT AREAS
- REMOTE LOCATIONS
- PROBLEM INSTALLATIONS

- *Quick, easy to install*
- *Minimum maintenance*
- *100% efficient*
- *Automatic control*
- *Clean, fan-circulated heat*
- *User Satisfaction*

SUSPENSION TYPE MODELS

10,000 to 45,000 watts. For complete or auxiliary heat in large areas. Adjustable louvers for directing heat where desired.

Model 14-10

COMBINATION PORTABLE and Suspension Type Models

1500 to 7500 watts. Plug in temporarily or mount on swivel brackets. Adjustable louvers.

Model AN-30A

FOR HOMES - OFFICES - MOTELS STORES ETC.

Electromode Wall-Type Heater has built-in thermostat for individual room temperature control. Fan-circulated heat is distributed by down-flo principle. 1500 to 4000 watt capacities.

Model WA

100% SAFE

Hot resistor wires are insulated and embedded within a finned aluminum casting, assuring positive protection from fire, shock or burn. This finned type element acts as a superior heat diffuser, resulting in greater heating economy.

5 YEAR GUARANTEE

The patented, cast-aluminum heating element is guaranteed for five years against all defects of material or workmanship.

The Famous GE UNIT MOTOR

Totally enclosed construction protects motor from entry of dust. Large supply of oil sufficient for years of motor operation is factory-sealed-in. Forced lubrication system assures long life and quiet operation.

SAFETY SWITCH

Built into every Electromode Heater is a small thermal safety switch, located on or near the heating element. If for any reason the air flow should stop, causing overheating of the element, this safety switch automatically shuts off the current.

Approved by Underwriters' Laboratories

ELECTROMODE CORPORATION

45 CROUCH ST., DEPT. HP-84 ROCHESTER 3, N. Y.

Please send free literature on:

Electromode Heaters ☐ Domestic ☐ Industrial

NAME_____

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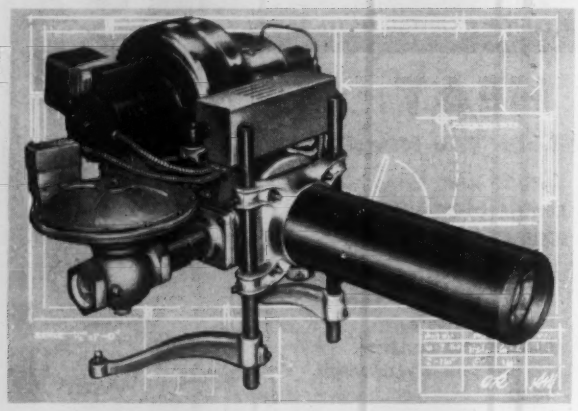
CITY_____ ZONE_____ STATE_____

NOW you can specify GAS burners



for your space heating and processing requirements.

AUTOMATIC SWITCHING syncro-flame DUAL-FUEL gas/oil burners

Burn either gas or oil with completely automatic fuel-air changeover at maximum efficiency. Satisfy utility requirements as to gas availability. Operating by outside thermostatic control or remote manual operation. Syncro-flame dual-fuel burners answer your space heating requirements with models ranging in size from 100,000 to 3,000,000 BTU's p/hr on gas—1 to 22 gals. p/hr on oil. 2 to 60 boiler HP.

Write us for full information and help on your space heating and processing problems.

U.L. approved—cities of Minneapolis, Omaha, St. Louis and state of Mass. Fire Marshall approved.

Synchronous flame produces both Dual-Fuel and Gas Units in all size ranges above.

DUAL syncro GAS • OIL flame BURNER

synchronous flame inc.

210 N. Main St., Walworth, Wis.

WHO'S WHAT

Continued

handle employee recruiting work in colleges and universities.

▶ *G. V. LEECE* has been elected president of *GARDNER-DENVER CO.* and *BENJAMIN C. ESSIG* has been elected executive vice president.

▶ *A. F. WOODS*, former Marlow district engineer, has succeeded *A. S. RUBIN* as sales manager for the *MARLOW PUMP DIV.* of *BELL & GOSSETT CO.* Mr. Rubin is setting up a business of his own in Florida.

IN THE TERRITORIES . . .

▶ For *BURGESS-MANNING CO.—JACOBSON & CO.* has been named territorial contractor for the company's "3-Way Functional Ceiling" for New York, New Jersey and eastern Pennsylvania.

▶ For the *BABCOCK & WILCOX CO.—N. J. CONNOR* is manager of the New York district office, replacing *H. E. MARTIN*, who has resigned to become president of *METAL & THERMIT CORP.*

▶ For *RHEEM MFG. CO.*—New California distributor is the *SOUTHWEST AIR CONDITIONING SUPPLY CO.*, 233 S. Beverly Dr., Beverly Hills. *GEORGE P. MANDEL* has joined the firm as sales manager.

▶ For the *GARMAN CO., INC.*—The *WATER-SAVER CORP.*, 17 E. 42nd St., New York, is representative in New York, New Jersey and New England.

▶ For *AIR REDUCTION SALES CO.—D. F. McCANDLISH*, manager of the district office in Chicago, now is manager of the north central region with headquarters in Chicago. *S. S. BRUCE, JR.*, zone manager, eastern region of the company's Railroad Dept., succeeds Mr. McCandlish as Chicago district manager.

▶ For *MAID-O'MIST, INC.*—The representative for eastern Pennsylvania, southern New Jersey and Delaware is *EDGAR & BLACK.*

▶ For *ARMCO STEEL CORP.—PAUL F. PARDONNER* has been named assistant manager of the Detroit sales district. He has been a member of the Detroit sales staff for the past eight years.

▶ For *WOLVERINE TUBE DIV.*, Calumet & Hecla, Inc.—*W. T. IRELAND* has been appointed sales

BLACK & DECKER PORTO-SHEARS* Cut Job-Time 75%

REAL time-, trouble-, and labor-savers . . . Black & Decker Porto-Shears.

Porto-Shears *cut many times faster than hand snips* . . . often cut where snips won't cut at all. And do it easily, cut muscular strain.

Available in two sizes (16 and 12 gauge capacities) Porto-Shears *give excellent results.* Cutting action eliminates burrs and ragged edges. Shoe construction permits cutting to small radii. Visible blade makes it easy to follow patterns.

Cut many materials . . . steels, Monel, copper, aluminum, lead . . . thin plastic sheets and wood laminates.

Like all B&D Tools, Porto-Shears are made with husky housing, precision parts and powerful B&D-built motor. As a result Porto-Shears give outstanding service . . . save time, cut costs on every job. Price: $95.00 and $135.00. See demonstration at your B&D Distributor. (Listed under "TOOLS-Electric in classified telephone directory".) Also, send for Catalog No. 10. Address: THE BLACK & DECKER MFG. CO., 640 Pennsylvania Ave., Towson 4, Md.

*Reg. U.S. Pat. Off.

LEADING DISTRIBUTORS EVERYWHERE SELL

B&D Black & Decker PORTABLE ELECTRIC TOOLS

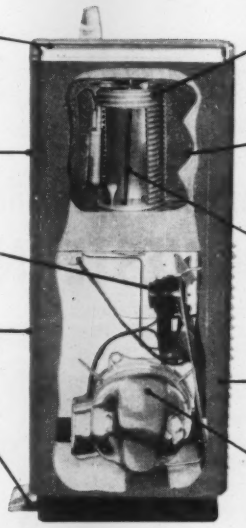
We invite you to...

LOOK INSIDE

it's the sturdy . . .

TEMPRITE

Drinking Water Cooler


SANITARY Stainless Steel Top is EXTRA DEEP. No splash from overflow — no spurt from nozzle.
WATER TEMPERATURE can be adjusted as desired.
FAN MOTOR assembly lifetime lubricated.
CABINET PANELS are heavy gauge sheet steel. Neutral grey baked finish.
POSITIVE ACTION FOOT PEDAL is standard, yet hand or dual control is available if desired.
COOLER and storage tank has all-welded seams.
MOISTURE PROOF, vermin proof, presettled cork insulation.
PATENTED INLET Water Tube increases efficiency, protects cooler against damage from freeze up.
ALL JOINTS and connections silver soldered.
HERMETICALLY SEALED compressor lubricated for life.

The Cooler with the DEEP Stainless Top!

Stainless Steel won't crack or chip.

Easy to clean and keep clean!

Temprite Products Corporation
P. O. Box 72-L, East Maple Rd.
Birmingham, Michigan

Send me distributor franchise information, I am interested in handling Temprite Water Coolers.

Name_____

Address_____

City_____ State_____

WHO'S WHAT

Continued

representative, with headquarters in the firm's general sales office in Detroit. Also named as sales representatives are *ROD DAVIES* and *STUART MAISE*.

▶ For *CONOFLOW CORP.*—The *WATTS CO.*, 4101 San Jacinto St., Houston, now is sales representative in southeast Texas and southwest Louisiana.

▶ For *REYNOLDS METALS CO.—PETER A. FRASSE AND CO.*, will distribute the firm's aluminum products.

▶ For *STERLING, INC.—E. M. TARNOFF CO.*, Norwalk, Conn., is the new representative for Connecticut.

▶ For *CARVER PUMP CO.—WILLIAM A. McMAHAN* is western district sales manager and will cover Arizona, California, Oregon, Washington, Nevada, Utah, Idaho, Wyoming and Montana. He lives in Rolling Hills, Calif.

▶ For *TYPHOON AIR CONDITIONING CO., INC.*—Three new district managers have been appointed. *JACK ATKINS* will supervise the central southern sales territory, including Arkansas, Tennessee, Louisiana, Mississippi and part of Kentucky, with headquarters in Shreveport, La. *JOHN OBRIG* will manage sales on Long Island, in Westchester County and the Bronx, with headquarters at the central plant in Brooklyn. *DOUGLAS S. STERNER* will represent Typhoon's line of commercial and residential air conditioning equipment in Alabama, Georgia, North and South Carolina and part of Florida, with headquarters in Atlanta.

▶ For *FRICK CO.*—The *CENTRAL ICE MACHINE CO.*, 5014 S. 24th St., Omaha, Neb., is the new distributor for Nebraska, eastern Iowa, and southern South Dakota.

▶ For *UNITED STATES AIR CONDITIONING CORP.—F & D DISTRIBUTORS, INC.*, Salt Lake City, has been named a distributor for packaged air conditioners, self contained central station air conditioning plants and self contained water chillers. The territory to be covered includes Utah, Idaho and the bordering areas in Wyoming and Montana.

▶ For *A. M. BYERS CO.—WILLIAM E. WEBER* is now a field service engineer in the Seattle area. He

Where the problem is ventilation — the solution is a **WESTERN SYSTEM**

AT NORTHROP AIRCRAFT INC.

Problem: The Anaheim, Calif. Division of Northrop Aircraft, Inc. manufactures optical range finders and other ground weapon fire control devices for U.S. Army Ordnance. Dust-free ventilation a must! Solution: 38-30" Western Rotaries with Western-aire Curb-Mounted fans exhaust 18 million cubic feet of air per hour from the 250,000 sq. ft. building.

AT YOUR PLANT

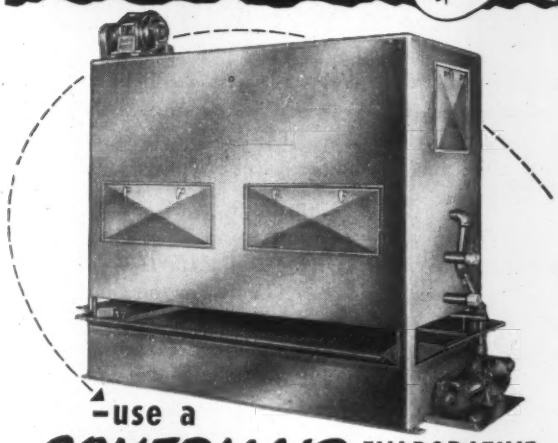
Western Rotary ventilators, with or without fans, can do the most for you. A 2 mph wind operates the Western Rotary—and it continues to exhaust during wind lulls due to superior balance design. Years of trouble-free performance—bearings carry lifetime guarantee. Check Sweet's or AEC for high exhaust capacity figures. Then specify Western—a first-rate line of rotary, stationary, continuous ridge, directional ventilators and exhaust fans. Handled by wholesalers coast to coast.

Western Engineering & Mfg. Co.

4118 OCEAN PARK AVE. • VENICE • CALIF.

Dealers—order from your local jobber.
Write for catalog, or tell us your special installation problems.

When water is a *Headache...*



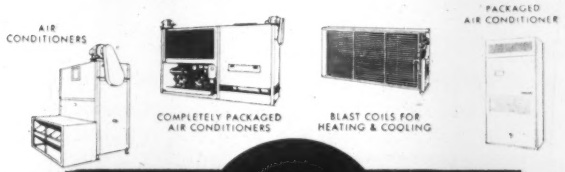
-use a GOVERNAIR EVAPORATIVE CONDENSER

Water supply for air conditioning *can* cause you a lot of trouble. When there's a shortage; when rates are expensive or when sewage and piping are impractical—*water becomes a real headache!*

That's when engineers and contractors alike turn to Governair Evaporative Condensers!

Governair Evaporative Condensers eliminate waste-water disposal problems and pumping costs. And they're engineered to give maximum efficiency and performance at a reasonable cost. Available in sizes from 3 to 100 tons.

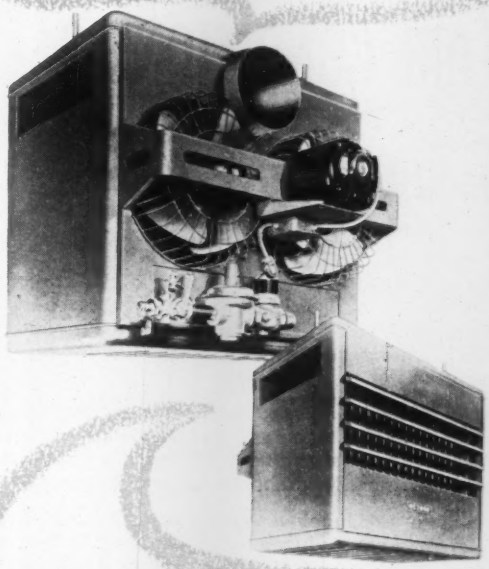
Choose a Governair Evaporative Condenser and there's no need for aspirin! GOVERNAIR CORPORATION, 513 N. BLACKWELDER, OKLAHOMA CITY, OKLA.



GOVERNAIR

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

NEW-Reznor's 250,000 BTU twin-fan gas unit heater



a new solution for many industrial and commercial heating problems

Now you can use Reznor gas unit heaters on those big commercial and industrial jobs for which adequate equipment has never before been available. Reznor's 250,000 BTU gas-fired unit—the first of its size offered by any nationally-recognized unit heater manufacturer—is the heater you've been waiting for.

The twin-fan feature is new evidence of the engineering leadership which has made Reznor the world's largest-selling gas unit heater. The two fans, operating from a single heavy-duty 1/4 HP motor, provide more effective air distribution at a much lower noise level than could be obtained with a single larger fan. They move 3200 CFM with an air throw of 90 feet.

Despite its tremendous capacity and power, the new unit is amazingly compact. The cabinet is no higher than on Reznor's 175,000 BTU heater: 33 1/2". The 250,000 BTU model is 36" wide and 40-3/16" deep overall; cabinet depth is 24 5/8".

For more details on this revolutionary new heater, write today for your copy of specification sheet NPS-5401A. For the whole story on the complete Reznor line, ask for a copy of Catalog GN-52. **The Reznor Manufacturing Company, 51 Union St., Mercer, Pennsylvania.**

REZNOR

THE WORLD'S LARGEST-SELLING GAS UNIT HEATERS

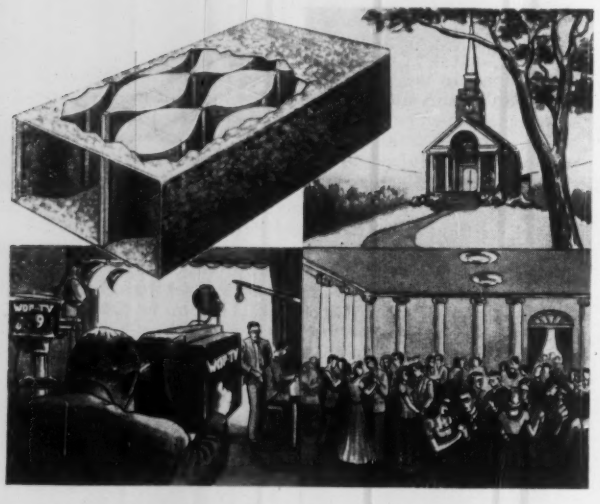
WHERE SILENCE IS AS IMPORTANT AS AIR CONDITIONING

specify Aircoustat

Whatever the location of your next air conditioning installation . . . ballroom, TV studio, church, hospital, office building, store or plant . . . if ***quiet*** *is required, Aircoustat offers the practical, economical solution to air conditioning noise!*

This compact, ***packaged*** *unit for silencing air and fan noise is easy to install. Incorporated as part of the duct work, it is attached by flexible connections . . . requires no special tools for installing.*

Aircoustat produces ***amazing*** *results. One* ***7 foot*** *unit, for example, reduces the noise level below what* ***100 feet*** *of old fashioned duct lining could accomplish . . . with low pressure drop. And selection is no problem. Aircoustat is so engineered that if it fits geometrically, it fits acoustically.*



Constructed of galvanized steel or aluminum, Aircoustats are available in 11 standard sizes for use with all styles and sizes of ducts, and in 3 types to meet any desired conditions.

Write today for free descriptive literature.

SILENCE SERVICE

Industrial Sound Control Inc.

45 Granby Street, Hartford 12, Conn.

WHO'S WHAT

Continued

will work out of the company's San Francisco division with an office in Seattle.

▶ For the *TRANE CO.*—*S. THOMAS SHIMANSKI* is head of a new branch sales office at 402 Palamino Lane, Madison, Wis.

▶ For *SERVEL, INC.*—All west coast operations have been centralized in a new Los Angeles location at 5545 E. Slauson Ave. The new facilities provide both office and warehouse space. *SEWARD ABBOTT* is in charge.

▶ For *KENNARD CORP.*—*F. W. JENIKE CO.* has been appointed sales representative in the Cincinnati area, which was formerly handled by the Dayton sales office. *FREY EQUIPMENT CO.* is the new sales representative for the Dayton and Columbus areas.

▶ For *VAPOR HEATING CORP.*—*WIRT FARLEY*, formerly west coast district manager, is transferring back to Chicago from San Francisco to be in charge of all non-railroad sales. *LOU A. RICHARDSON* is transferring to San Francisco to succeed Mr. Farley, after being district manager in Washington, D.C.

▶ For *ALLEN-BRADLEY CO.*— New district manager for the Detroit office is *JOHN W. MASON*, succeeding J. D. Peterson, who has retired.

▶ For *CARRIER CORP.*—The new firm of *CLIMATE ENGINEERING CO.*, 751 W. Eighth South, Salt Lake City, has been named distributor for Utah, Idaho, northeastern Nevada, western Montana and western Wyoming.

▶ For *UNION ASBESTOS & RUBBER CO.*—*E. H. LANGDON CO.*, 72 Vine St., Seattle, is sales representative in that city for "Unarco" heating and air conditioning units. In Des Moines, Iowa, *RUFUS G. SIPLE* is sales representative for heating units.

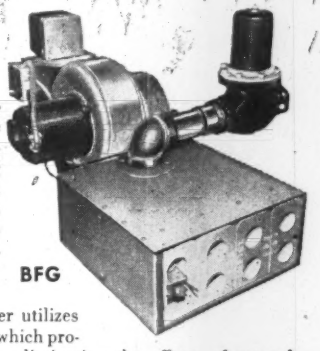
▶ *FLINN ENGINEERING CO.*, Memphis representative for *MARLO COIL CO.*, has opened a branch office in Little Rock, Ark. *JOHN A. COOPER* will manage it.

▶ For *READING TUBE CORP.*—Three new sales representatives have been added and the territories of two others have been increased. *JACK SALE* will cover North and South Carolina; *HERMON WARREN*, Georgia; and *CLARKE HOGAN*, Florida. *HO-*

Why So Many Heating Engineers SPECIFY

Power-Flame BURNERS

You'll find a Power-Flame Burner engineered to insure peak efficiency for EVERY Commercial, Industrial or Domestic Application.

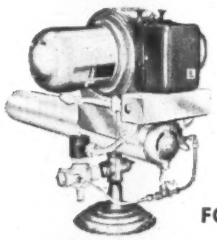


BFG

Regardless of application, whether it be straight gas or combination gas-oil, heating engineers know that Power-Flame burners supply fuel-saving, easy-to-install, high-efficiency heating.

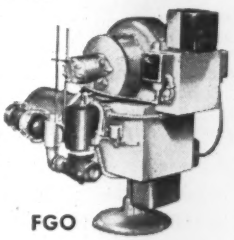
Every Power-Flame burner utilizes quiet, amply-sized blowers which provide balanced air mixture, eliminating the effects of natural draft conditions, and thus, providing metered air for complete combustion and highest heating plant efficiencies even in down-draft boilers or furnaces.

BFG Series (pictured above), 8 models in capacities from 450,000 BTU to 9,000,000 BTU input. With these features... factory wired—controls and valves mounted...wired sequencing panel provide purge period for utmost safety...positive control of air for combustion...dollar for dollar, the industry's best buy.



FG

FG Series 3 gun type units—Model FG 175, capacity 175,000 BTU, AGA listed; Model FG 330, capacity 330,000 BTU, AGA listed; model FG 500, 500,000 BTU. Ideal for replacement of oil burner... serves a wide range of hard-to-fire applications.



FGO

FGO Series—Combination Gas-Oil—6 models in capacity to 3,500,000 BTU input. Features include...automatic ignition for BOTH fuels...automatic air adjustment...electronic safeguard ...factory assembled and tested for both gas and oil. Automatic or manual changeover optional.

A Power-Flame dealership can be valuable. Write today for complete information.

Siemon Power-Flame BURNER

Manufacturing Co.

1819 HOLMES DEPT. HP KANSAS CITY, MO.

Under severe service conditions such as this chemical plant encounters every day, Transite Industrial Vent Pipe has proven its high resistance to aggressive fumes. In numerous installations, it has conveyed such fumes for periods up to 20 years and more, often outlasting, many times over, the materials previously used.

Because it is made of asbestos and cement, Transite Pipe cannot rust nor rot. Resistant to many corrosive fumes, vapors and dusts encountered in industry, it assures long service life. Whether used indoors or out, it needs no painting or other protective coating. Stands up under diverse weather conditions.

Transite Industrial Vent Pipe is easy to install. Light in weight, it is handled readily—can be cut on the job without special equipment. Its wide range of sizes, and complete line of fittings make it adaptable to almost every industrial venting service.

For additional information about the use of Transite Industrial Vent Pipe for your venting problems write to Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville

TRANSITE INDUSTRIAL VENT PIPE

Lo-BLAST Burners heat this huge Cincinnati apartment building.

FOR EVERY TYPE OF BUILDING

LO-BLAST

IS THE LOW-COST WAY TO HEAT WITH GAS

Every dollar trimmed from operating expense shows up on the profit side of the ledger. That's why fuel-saving Lo-BLAST Power Gas Conversion Burners are the sensible selection for buildings which must produce income . . . or for home owners concerned with keeping living costs down.

Lo-BLAST operating cost averages 10% less

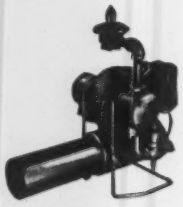
The Lo-BLAST principle of combustion utilizes an extremely quiet, low speed blower to provide perfectly controlled primary and secondary air. Hence operation is always independent of natural draft conditions—makes the Lo-BLAST ideal for down-draft boilers. Combustion is completed in an incandescent firebox, with radiant heat applied to the crown sheet as well as side walls. There's no combustion roar—the flame is soft and *quiet!*

High efficiency on intermittent operation

Lo-BLAST Burners show only a small drop in over-all efficiency when changing from constant to intermittent operation. This is the reason for Lo-BLAST fuel economy, since intermittent operation is the normal condition for any heating plant.

Factory-tested on gas, shipped completely assembled

Installation and servicing are easy *because there's nothing in the firebox but the fire!* All units have standard controls with positive acting pilot and blower safetys.



Lo-BLAST Economite
Residential size—70,000 to 500,000 BTU—with all the fuel-saving features of the standard Lo-BLAST.

Capacities from 70,000 to 20,000,000 BTU input. Write for engineering data.

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

WHO'S WHAT

Continued

BART E. BALDWIN, serving Maryland and Washington, D.C., will cover Virginia also. *HARWELL and ROSSELOT*, now serving Arkansas, will also cover Tennessee.

▸ For *DUNKIRK RADIATOR CORP.—THOMAS G. JONES* is the new field representative covering the state of New York. His office is at 1223 Oak St., Utica. The firm of *OLIVER & BRINK*, 4423 Washington St., Roslindale, Mass., has been named the representative for Massachusetts, New Hampshire, Rhode Island and southern Maine.

▸ For *CORY CORP.—JOHN A. VAN DAM* has rejoined the firm as sales representative in the Chicago area. For a time, Mr. Van Dam was Chicago district territory manager for the appliance division of General Mills.

▸ For *CENTURY ENGINEERING CORP.—JOHN S. DAVIS* is district manager in the southeastern states. His territory includes southern Virginia, North and South Carolina, Georgia, and parts of Tennessee and West Virginia.

▸ For *ALLEGHENY LUDLUM STEEL CORP.*—New district manager in Milwaukee is *DAVID L. GARLICK*, who succeeds *FRANK W. LADKY*. Mr. Ladky will become assistant to the president.

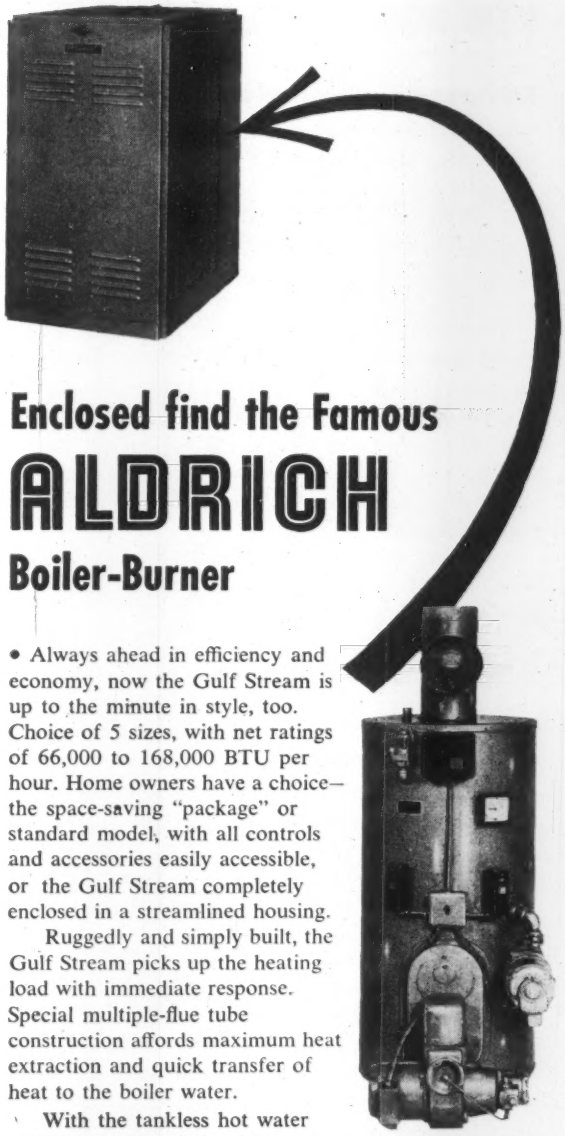
▸ For *STERLING ELECTRIC MOTORS, INC.—JOSEPH H. FALLON* is the new Cincinnati district sales manager.

▸ For *ESSEX WIRE CORP.—S. C. GOODLING* has been appointed field sales engineer in the Chicago area.

▸ For *PITTSBURGH PLATE GLASS CO.—PETER J. BAIER, JR.* has joined the sales staff of the fiber glass division in Chicago.

▸ For *CHRYSLER AIRTEMP*—The *EASTERN CO.*, Providence, R.I., and Cambridge, has been named to distribute the line of packaged commercial and residential air conditioners in a five-state New England area.

▸ For *YORK CORP.—OSCAR L. MacDONALD* is accessory equipment and maintenance representative at the middle Atlantic district office in Philadelphia. He will supervise sales of accessory equipment to authorized jobbers in New York, Philadelphia and Delaware.



Enclosed find the Famous

ALDRICH

Boiler-Burner

• Always ahead in efficiency and economy, now the Gulf Stream is up to the minute in style, too. Choice of 5 sizes, with net ratings of 66,000 to 168,000 BTU per hour. Home owners have a choice—the space-saving "package" or standard model, with all controls and accessories easily accessible, or the Gulf Stream completely enclosed in a streamlined housing.

Ruggedly and simply built, the Gulf Stream picks up the heating load with immediate response. Special multiple-flue tube construction affords maximum heat extraction and quick transfer of heat to the boiler water.

With the tankless hot water coil added, the unit furnishes not only heat but hot water supply as well. Write for complete details.

GULF STREAM Standard

Comes fully erected, equipped with a complete set of automatic controls for 115 volt, 60 cycle operation, including thermostat, stack switch and limit control. Combustion chamber is installed. Top jacket removable without disconnecting water piping.

HOT WATER HEATERS

Internally galvanized, high delivery direct heating, no slow storage. **SERIES "B"**—93 to 850 GPH at 100° F. rise. **SERIES "C"**—100 to 255 GPH at 100° F. rise.

Gulf Stream

PACKAGE

Fully erected, pre-wired, accessory-equipped. Ready to set in place and connect. Easy to install and service.

ANOTHER BREEZE MARK PRODUCT

ALDRICH COMPANY

105 WILLIAMS STREET • WYOMING, ILLINOIS

A SUBSIDIARY OF BREEZE CORPORATIONS, INC.

Cut customer fuel bills 7 days a week

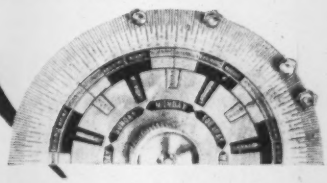
it's good business to always install a PARAGON 700 Series Calendar Time Switch on commercial heating units

YES, the good word gets around fast when a Paragon 700 Series Time Switch is on the job cutting heating bills. Heat is *automatically turned off* when not needed. Customer satisfaction through lower fuel bills *plus* fewer service "call backs" are big profit boosters for you! Check these features: :

• **COMPLETELY FLEXIBLE** — completely economical. Switch settings can be made for the entire week's schedule, yet easily and quickly changed. ON-OFF or OFF-ON operation can be as close as 3 hours.

• **FULLY AUTOMATIC** — set it, then forget it. Saves money weekends, for example: switch may be set to cut off heat Saturday noon, then automatically start regular heating cycle earlier than usual Monday.

• **INSTANTLY CHANGEABLE** — simply set the dial trippers at desired day or night hours. Total of 14 are supplied as standard equipment.



Ask for Bulletin HP-5407

See your jobber, or write:

Dial is graduated in hours and half-hours. Night and day periods clearly separated. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. No complicated wiring. Lists as low as $27.50.

PARAGON ELECTRIC COMPANY

TWO RIVERS, WISCONSIN

World's Foremost Manufacturer of Time Controls

NOW

A Brand New Profit-Maker for Heating Contractors

THERMOBLOC

TYPE AF

2 MILLION BTU

DIRECT-FIRED HEATER

• Easy to Sell • Easy to Install • Quick Profits

Check these fast selling features! Easy to install. Occupies comparatively small space . . . heats up to approximately 24,000 sq. ft. . . . circulates an even blanket of heat directly at working level or through air ducts. The new THERMOBLOC Type AF is a premium heater designed for unlimited industrial applications!

No other direct-fired heater has THERMOBLOC'S exclusive design and boiler-type construction features. THERMOBLOC presents a new concept of heat transfer efficiency . . . engineered and developed to heat large open areas in warehouses, factories, commercial garages, machine shops, and similar hard-to-heat buildings. THERMOBLOC is industry's answer for low-cost and highly efficient heat.

Send coupon for complete details on how you can profit on your next heating job by installing THERMOBLOC.

THERMOBLOC
DIVISION OF
PRAT-DANIEL CORP.
5-8 MEADOW ST. SOUTH NORWALK, CONN.

PRAT-DANIEL CORP.
5-8 Meadow St.
South Norwalk, Conn.

Gentlemen:
Please rush Bulletin 5/54 on the NEW, EASY-TO-SELL THERMOBLOC Type AF Model 2000. I would like more information on a distributorship. My Company resume is enclosed.

Name.....Title.....
Company.....
Address.....
City.....State.....

NEW BOOKS & REPORTS . . .

Radiant Heating and Cooling

Last fall the School of Architecture at Pratt Institute in Brooklyn conducted a series of six conferences on radiant heating designed to present a comprehensive review of the present developments and future potentialities of radiant heating and cooling. The booklet, *Radiant Heating, Radiant Cooling, 1954*, is a condensed report of the proceedings.

The report is divided into several sections, as the conferences were, to cover basic theory, history of radiant heating, radiant systems today, accumulated evaluation of advantages and disadvantages, the problem of time lag and some solutions, control systems, radiant cooling and air conditioning, design considerations, pipes and pumps, large scale applications of radiant heating, and snow melting.

Copies of the book may be ordered from the Pratt Institute, 215 Ryarson St., Brooklyn 5, N.Y., for $1.00 a copy.

AEC Reports for Industry

A new series of bibliographies, *Selected AEC Reports of Interest to Industry*, has been compiled and released by the Atomic Energy Commission to provide American industry with non-secret literature concerning technology developed in the atomic energy program. The new bibliography series presents about 800 reports considered of particular interest to industry. The reports are divided into industry categories.

The entire set, or individual sections of the series, may be purchased from the Office of Technical Services, Dept. of Commerce, Washington 25, D.C. Cost of the set is $2.25, while costs of individual sections are: Chemistry & Chemical Engineering, 45 cents; Construction & Civil Engineering, Mining & Geology, 25 cents; Electronics & Electrical Engineering, 35 cents; Health & Safety, Industrial Management, 25 cents; Mechanics & Mechanical Engineering, 25 cents; Metallurgy & Ceramics, 35 cents; and Nuclear Technology, 35 cents.

ASME Semi-Annual Meeting Papers

Prior to its semi-annual meeting in June, the American Society of Mechanical Engineers prepared a series of preprints of papers to be presented at the meeting.

Among the papers contributed by the Heat Transfer Div. were: *A Note on Limiting Laminar Nusselt Number in Ducts with Constant Temperature Gradient by Analogy to Thin-Plate Theory*, by Prof. S. M. Marco, Dept. of Mechanical Engineering and L. S. Han, research associate of the department, Ohio State University; *Heat Transfer from Sphere to a Rarefied Gas in Subsonic Flow*, L. L. Kavanau, research engineer, University of California; *An Investigation of the Effect of a Step in the Surface Temperature on the Heat Transfer to a Laminar Boundary Layer*, L. J. Gee, research engineer, Detroit Controls Co., and R. A. Seban, associate professor of mechanical engineering, University of California; *Heat Transfer from a Rotating Plate*, R. L. Young, associate professor of

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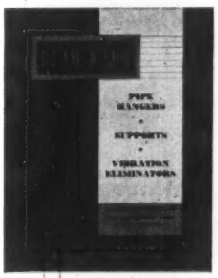

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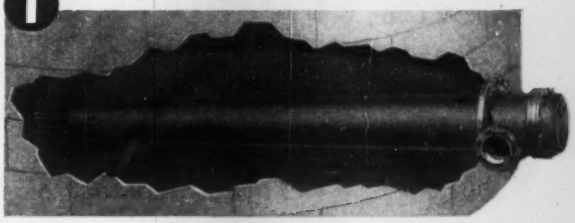

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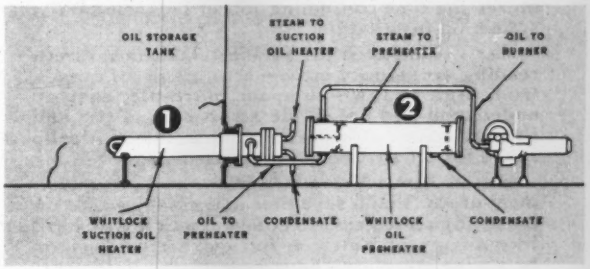

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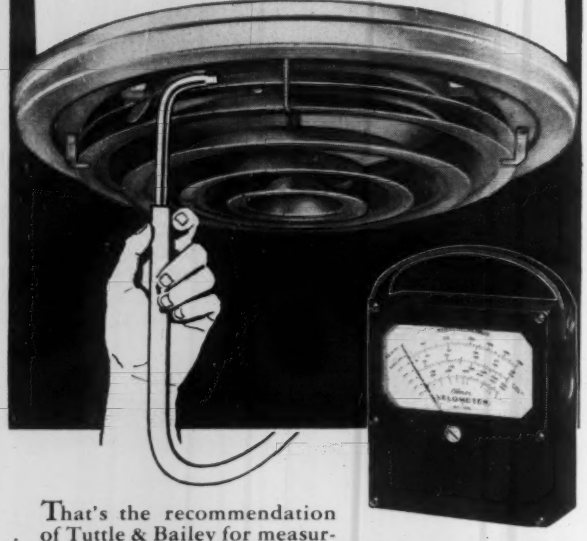

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NEW BOOKS & REPORTS *Continued*

mechanical engineering, Northwestern University; *Temperature Charts for Internal Heat Generation*, M. P. Heisler, research engineer, North American Aviation, Inc.; An *Electrolytic Analog Applied to the Solution of a Thermal Conduction Problem*, P. E. McNall, Jr., supervisor in general research, and J. E. Janssen, research engineer, Minneapolis-Honeywell Regulator Co.; *Use of Numerical Analysis in Transient Solution of Two-Dimensional Heat-Transfer Problem with Natural and Forced Convection*, Stanley K. Hellman, George Habetler and Harold Babrov of the General Electric Co.; *A Test Loop for Determining Heat-Transfer Coefficients by the Thermal-Cyclic Method*, L. S. Mims, supervisory engineer, and J. A. Kleber, senior engineer, Atomic Power Div. of Westinghouse Electric Corp.; *A Systematic and Rapid Procedure of Computing Approximate Characteristic Values Pertaining to Bare-Tube Cross-Flow Heat Exchangers*, F. J. Neugebauer, General Electric Co.

A paper presented by the Power Div. at the meeting was *Working Stress Criteria for Nuclear Power Plants*, by B. F. Langer, consulting engineering, Atomic Power Div., Westinghouse Electric Corp.

Contributed by the Process Industries Div. was *Fanning Friction Factors for Air Flow at Low Absolute Pressure in Cylindrical Pipes*, W. J. Bohnet, research engineer, Electro-Metallurgical Co., and L. S. Stinson, Development Contract Dept., Elliott Co.

The Instruments & Regulators Div. presented the paper, *A Thermal Sine-Wave Apparatus for Testing Industrial Thermometers*, by Stephen P. Higgins, Jr. and Jonathan R. Keim, research and development engineers, Minneapolis-Honeywell Regulator Co.

Preprints are available from the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, until April 1, 1955.

Corrosion in Piping, Heating Equipment

Corrosion in Piping and Heating Equipment reviews in general terms the principles of corrosion related to these two fields. The author, Floyd Brown, research associate professor of metallurgy at North Carolina State College, discusses corrosion in hot water storage tanks, piping, boilers, and condensate return lines and the measures taken to combat the various types of corrosion. The nature of public water supplies is also covered.

The booklet has been published by the Dept. of Engineering Research, North Carolina State College, Raleigh, and is priced at 50 cents a copy.

Forming and Bending Aluminum

Procedures and technical advancements in forming and bending aluminum are presented in a 272-page book prepared and published by the technical writing department of Kaiser Aluminum & Chemical Sales, Inc. Titled *Forming and Bending Kaiser Aluminum*, the book gives comparative data on various types of forming and bending equipment; characteristics of specific alloys and their suitability to particular operations; comparison of methods, and technique suggestions to solve specific production problems. A comparative study of aluminum with some of the ferrous metals is also made for different applications to assist in product design.

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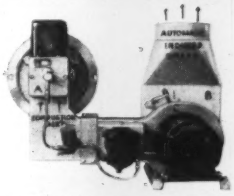

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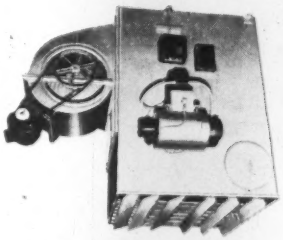

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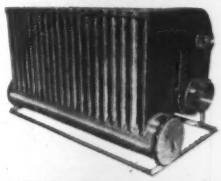

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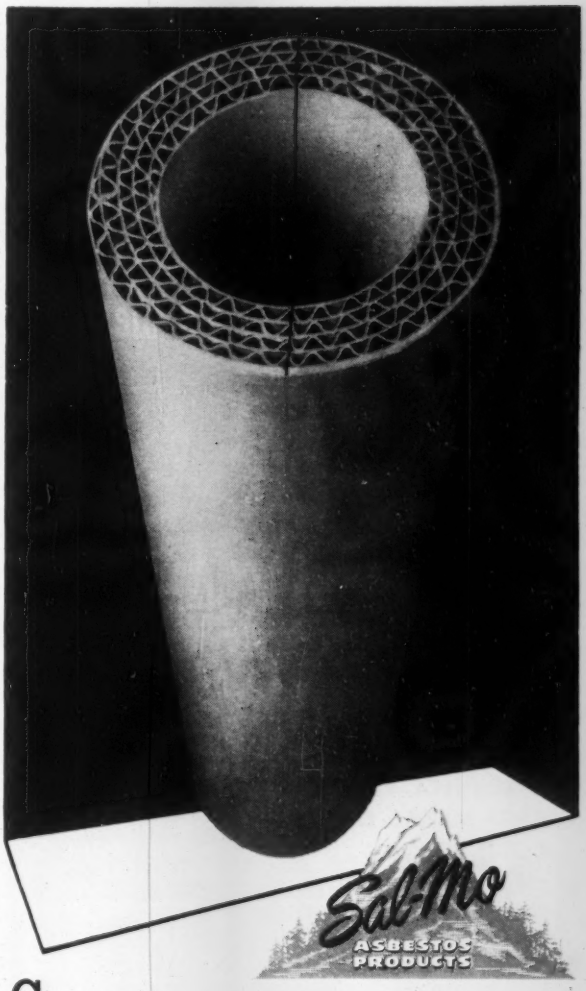

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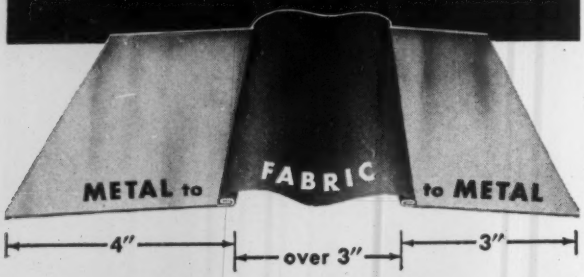

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NEW BOOKS & REPORTS

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Copies of the book may be obtained free of charge when requested on company letterhead, or at a cost of $2.00 for personal libraries. Copies are available from the Technical Editor, Kaiser Aluminum & Chemical Sales, Inc., 919 N. Michigan Ave., Chicago 11.

OTHER BOOKS AND REPORTS . . .

VARIABLES IN MONTHLY DUST FALL MEASUREMENTS and a LOW COST SAMPLER for MEASUREMENT of LOW CONCENTRATION of HYDROGEN SULFIDE—two papers on the methods of measuring air pollutants, by J. Deane Sensenbaugh and W. C. L. Hemeon of the Industrial Hygiene Foundation.

Reprints of the papers may be obtained from the Foundation, Mellon Institute, 4400 Fifth Ave., Pittsburgh 13, Pa.

BIBLIOGRAPHY on FILING, CLASSIFICATION, and INDEXING SYSTEMS for ENGINEERING OFFICES and LIBRARIES—a selected list of references for those wishing to set up files in engineering offices or libraries.

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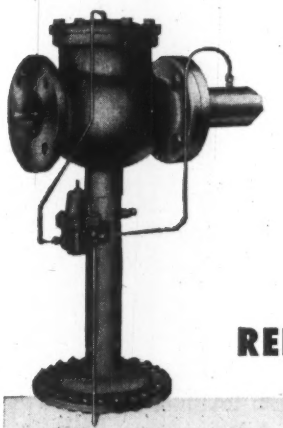
STATE BUILDING CONSTRUCTION CODE MANUAL—second edition, published by the State Building Code Commission of New York. The manual describes methods and materials acceptable as meeting the requirements of the state code, without prescribing their use. The booklet is divided into five parts corresponding to the major divisions of the code—general provisions, space standards, structural standards, fire safety standards and equipment standards.

It is supplied in limited quantity without charge to enforcement officers where the state code is applicable. Copies are available to the public at a price of $3.00 each from the State Building Code Commission, 1740 Broadway, New York 19.

HEATED ALUMINUM CEILINGS—an article dealing with a method for combining the acoustic treatment of ceilings with an established method of ceiling heating. A description is given of the mechanical services of a building where the heating is effected by this new method, and a special form of it where the



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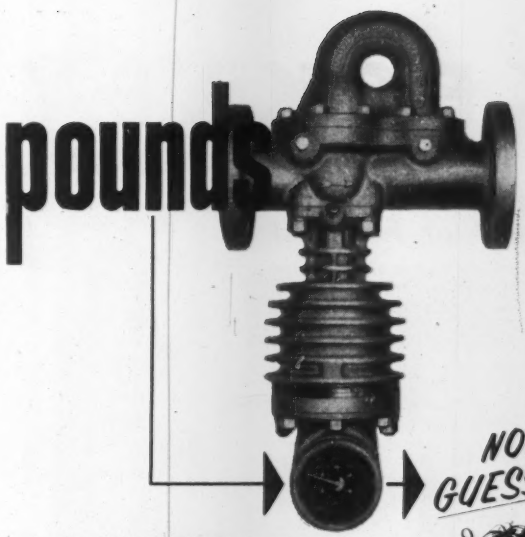

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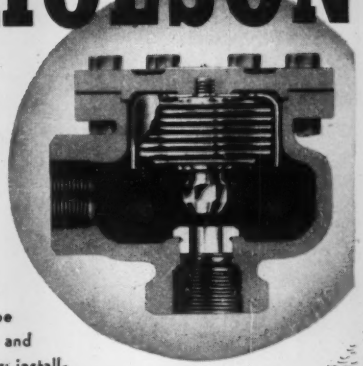

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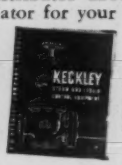

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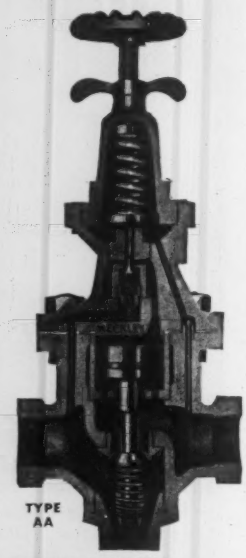

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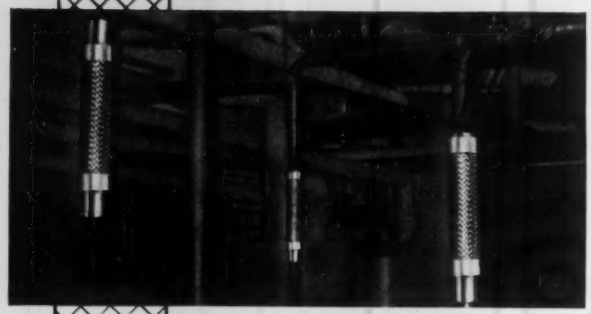

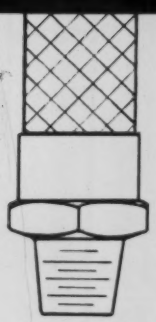

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NEW BOOKS & REPORTS

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ceiling elements are curved and treated to function also as lighting reflectors.

The article appeared in the journal of the Institution of Heating and Ventilating Engineers, 49 Cadogan Sq., London, S. W. 1.

MANUAL for PLASTIC WELDING, Polyethylene—description of methods of gas welding plastic materials with emphasis on polyethylene. In addition to details of the process, two chapters are devoted to the lining of tanks with polyethylene and polyethylene pipe lines.

Written by G. Haim and J. A. Neumann, the book is published by the Industrial Publishing Co., 1240 Ontario St., Cleveland 13, and is priced at $6.00 a copy.

1953 INDEX to ASTM STANDARDS—includes the list of titles in numeric sequence of all ASTM serial designations. The Index is an addition to the *Book of ASTM Standards* and is used as a reference for locating any standards in the bound volumes. The standards have been indexed under appropriate key words. The items under each subject are arranged

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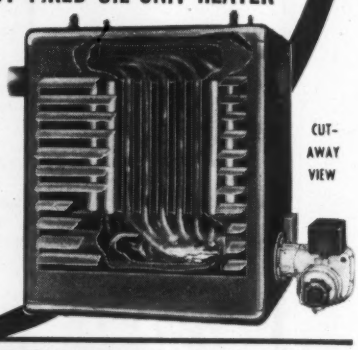

CUT-AWAY VIEW

*Patents Pending

DELTA HEATING CORPORATION, TRENTON 8, NEW JERSEY

alphabetically according to the significant word in the title.

It is published annually by the American Society for Testing Materials, 1916 Race St., Philadelphia 3.

I-B-R RATINGS—contains all I-B-R ratings in effect on April 1, 1954, for boilers and baseboards of all types currently being produced. Ratings for boilers made by 25 American and Canadian manufacturers are listed in the sixth edition. In addition, ratings for baseboards of all types made by 26 manufacturers are given.

Price of the booklet is 75 cents. Copies may be obtained from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

FILTRATION of RADIOACTIVE AEROSOLS by GLASS FIBERS, Parts I and II—study of the filtration properties of glass fibers for use in the disposal of radioactive waste gases. Tests were conducted at the Hanford Works of the AEC.

The booklets were published by the United States Atomic Energy Commission, Technical Information Service, Oak Ridge, Tenn.

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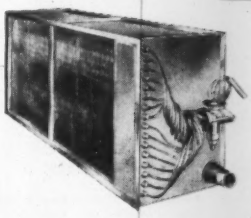

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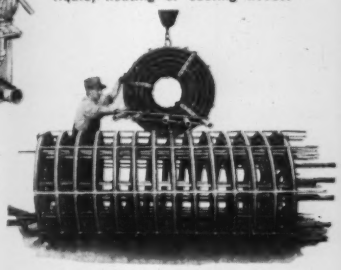

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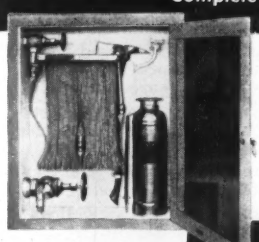

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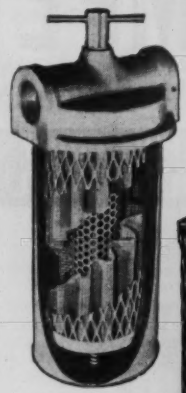
WATER FILTERS



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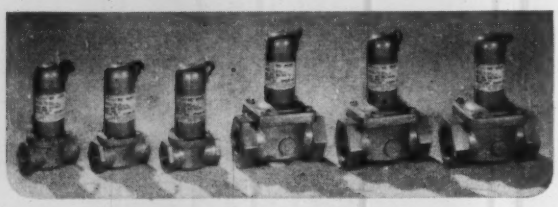
MEETINGS & CONVENTIONS

I-B-R SCHOOL OF MODERN HEATING—fall schedule of schools includes: Pittsburgh, Pa., August 17-19; Cincinnati, Ohio, August 24-26; Knoxville, Tenn., August 31-September 2; Chattanooga, Tenn., September 14-16; Nashville, Tenn., September 21-23; Winston-Salem, N. C., September 28-30; Charlotte, N. C., October 5-7. Tuition for the I-B-R School is $28.00. Those wishing further information may obtain it from the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

GAS MEASUREMENT—14th annual Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, August 23-25. Subjects to be covered include fundamentals of gas measurement and special session on domestic meters, large capacity meters, orifice meters, auxiliary measurement instruments, automatic control instruments, planning and design of installations, and pressure regulators, motor valves and related equipment.

NINTH INTERNATIONAL CONGRESS OF REFRIGERATION, Paris, August 31 to September 15—sponsored by the Institut International du Froid, 177 Boulevard Malesherbes, Paris 17.

Eclipse *Burning Issues*



Eclipse announces *new* line of *simplified* solenoid valves!

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Eclipse Valves—For information on the complete line of Eclipse Valves for safety shut-off and combustion control, write for Bulletin "M".

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*Trade-mark

MEETINGS & CONVENTIONS *Continued*

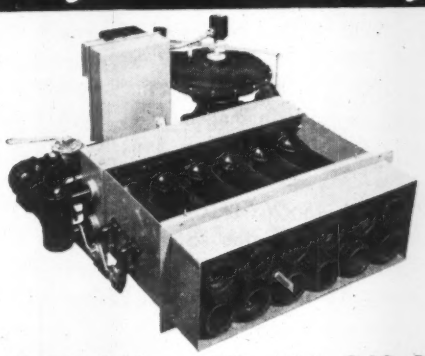
INTERNATIONAL INSTRUMENT CONGRESS AND EXPOSITION, 845 Ridge Ave., Pittsburgh 12. A number of professional societies are participating in making plans for the meeting to be held in Philadelphia. Technical sessions are scheduled to begin September 13 and continue until September 25.

AMERICAN GAS ASSOCIATION, 420 Lexington Ave., New York 17—36th annual convention, October 11-13, Atlantic City, N.J. Programs are being arranged for the association's Operating Section, Accounting, Home Service, General Management, and Industrial and Commercial Sections.

EIGHTH NATIONAL CHEMICAL EXPOSITION, The American Chemical Society, Chicago Section, 86 E. Randolph St., Chicago 1—Chicago Coliseum, October 12-15. Theme of the exposition is "The Chemical Industry in Everyday Living."

AMERICAN SOCIETY OF REFRIGERATING ENGINEERS, 234 Fifth Ave., New York 1—50th annual meeting, Philadelphia, November 28-December 1.

for Gas Firing



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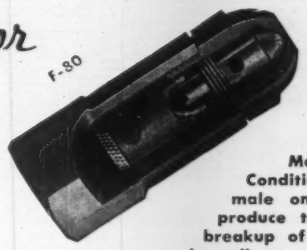

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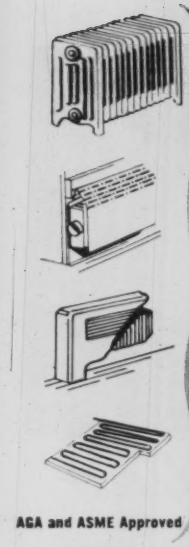

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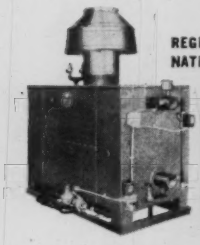

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MEETINGS & CONVENTIONS *Continued*

FIRST INTERNATIONAL AUTOMATION EXPOSITION 845 Ridge Ave., Pittsburgh 12—exhibit on automatic machines, factories and industries to be held the week of November 29 at the 242nd Coast Artillery Armory, 14th St. off Sixth Ave., New York.

The exhibit is under the direction of Richard Rimbach.

21st *NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING*, under the management of the International Exposition Co., 480 Lexington Ave., New York 17—Commercial Museum, Philadelphia, December 2-7.

WORLD SYMPOSIUM ON APPLIED SOLAR ENERGY, sponsored by Stanford Research Institute, Stanford, Calif.—January 12-15, 1955, Westward Ho Hotel, Phoenix, Ariz. Scientists and industrialists will attempt to evaluate present knowledge in terms of practical applications. Lewis W. Douglas is chairman of the meeting. Merritt L. Kastens, assistant director of Stanford Research Institute, is vice chairman.

AMERICAN SOCIETY OF HEATING & VENTILATING ENGINEERS, 62 Worth St., New York 13—61st annual meeting, January 24-27, 1955, Benjamin Franklin and Bellevue-Stratford Hotels, Philadelphia.

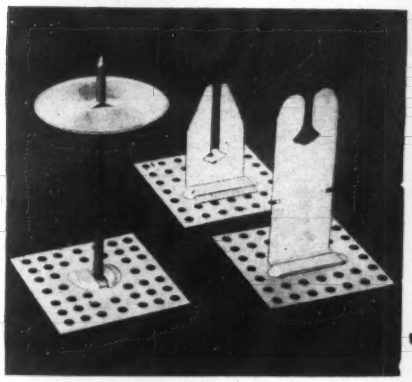
INTERNATIONAL HEATING & VENTILATING EXPOSITION—The Air Conditioning Exposition, January 24-28, 1955, Commercial Museum & Convention Hall, Philadelphia. Under the auspices of the American Society of Heating and Ventilating Engineers, and under the management of the International Exposition Co., 480 Lexington Ave., New York 17.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, Tulsa Section—Sixth Annual Corrosion Short Course for Pipeliners, February 16-18, 1955, Mayo Hotel. Thomas M. Ragland, Phillips Petroleum Co., is chairman of the course.

OIL-HEAT INSTITUTE OF AMERICA, 500 Fifth Ave., New York 36—33rd annual convention, tentatively set for the Edgewater Beach Hotel, Chicago, April 4-7, 1955.

AMERICAN SOCIETY FOR TESTING MATERIALS, 1916 Race St., Philadelphia 3—annual meeting, June 26-July 1, 1955, Chalfonte-Haddon Hall, Atlantic City, N.J.

The 1955 spring meeting is scheduled for January 31 to February 4 at the Netherland-Plaza Hotel, Cincinnati, Ohio.



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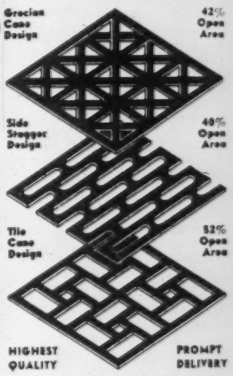

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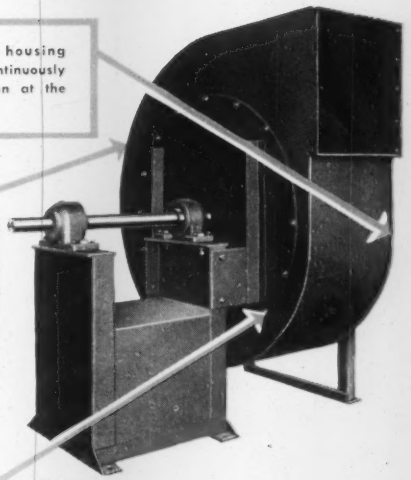
Heavy steel plate housing features a tight, continuously welded construction at the scroll.
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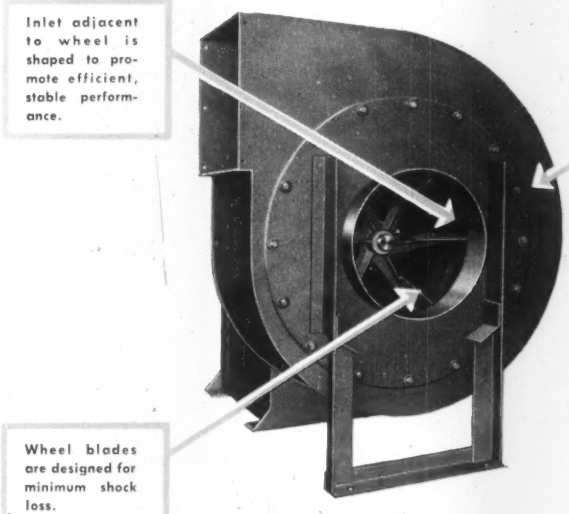
Adjustable to any of eight standard discharges by merely removing tap bolts on each side and rotating the housing between the sideplates.

Type XL fans shown here are typical of the smaller sizes which provide universal discharge. Larger sizes are of reinforced sheet steel and base angle construction extending to the foundation line.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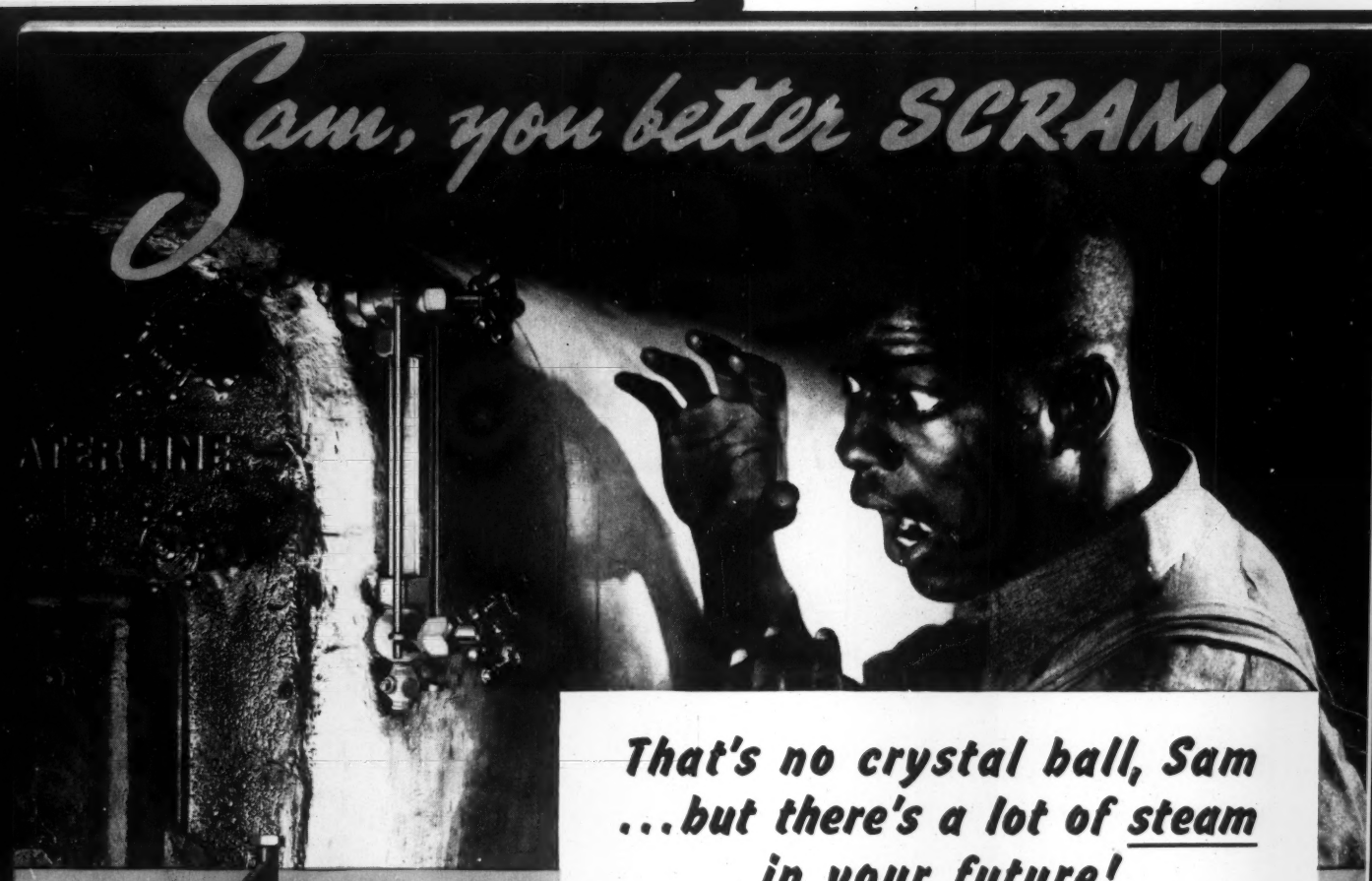
Sam, you better SCRAM!



That's no crystal ball, Sam ...but there's a lot of steam in your future!

If anybody has the idea that steam is on the downgrade — he'd better have another look. As it stands now, things are looking up in the steam business — and just getting off to a good start!

For instance, take the new Iron Fireman SelecTemp system, which uses low pressure steam to supply heat and to operate turbine-driven circulating fans upon individual room thermostat demand. Then, too, there's the growing recognition of the importance of steam in hot water heating systems. Like the setup that utilizes steam to water heat-exchangers at various building levels in high commercial structures. And the system that specifies installation of the steam boiler at the *high* point of a building, so that hot water drawn from below the boiler water level is circulated through the heating system and back to the boiler. Both good examples of hot water heating via the steam route!

That's how things go these days — *always* something new in steam heat. And as long as there are developments in boilers and heating systems, there'll be dependable McDonnell water level controls for any type or sizes . . . just as there are now. That's why the Sam-you-better-scram idea has a big future — and it's looking better all the time.

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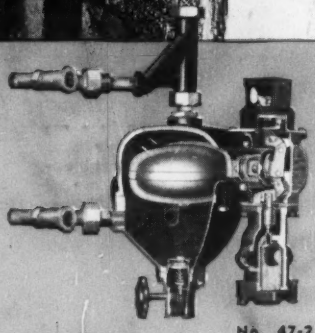
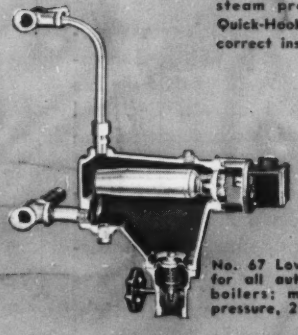


No. 47-2 Feeder-Cut-off Combination for boilers below 5000 sq. ft.; maximum steam pressure, 25 lbs. Quick-Hook-Up for speedy, correct installation.



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No. 150 Water Level Control for boilers of any size with steam pressures up to 150 lbs. Used as feed-pump control; low-water fuel cut-off; low water alarm switch, or any combination of these functions.

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